Engineering News-Record

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July 18, 1918

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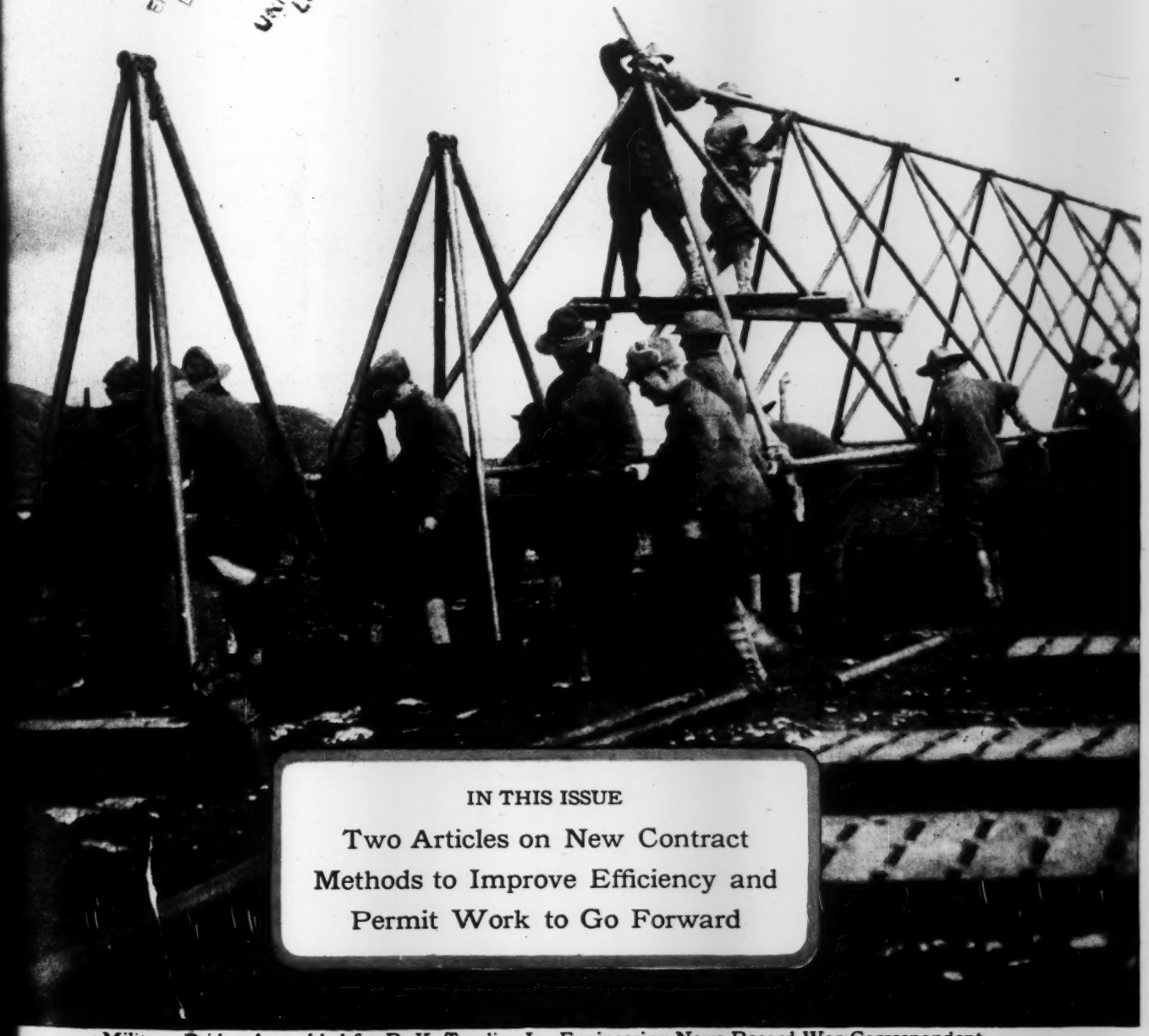

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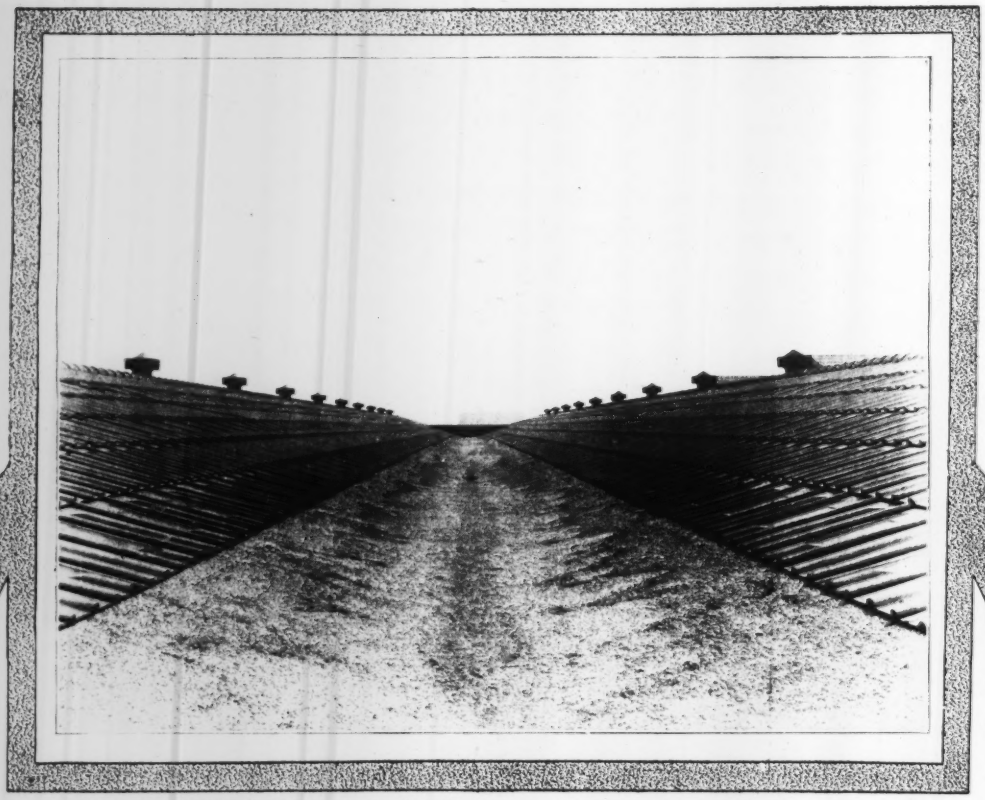

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Volume 81 July 18, 1918 Number 3

Engineering News-Record

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E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

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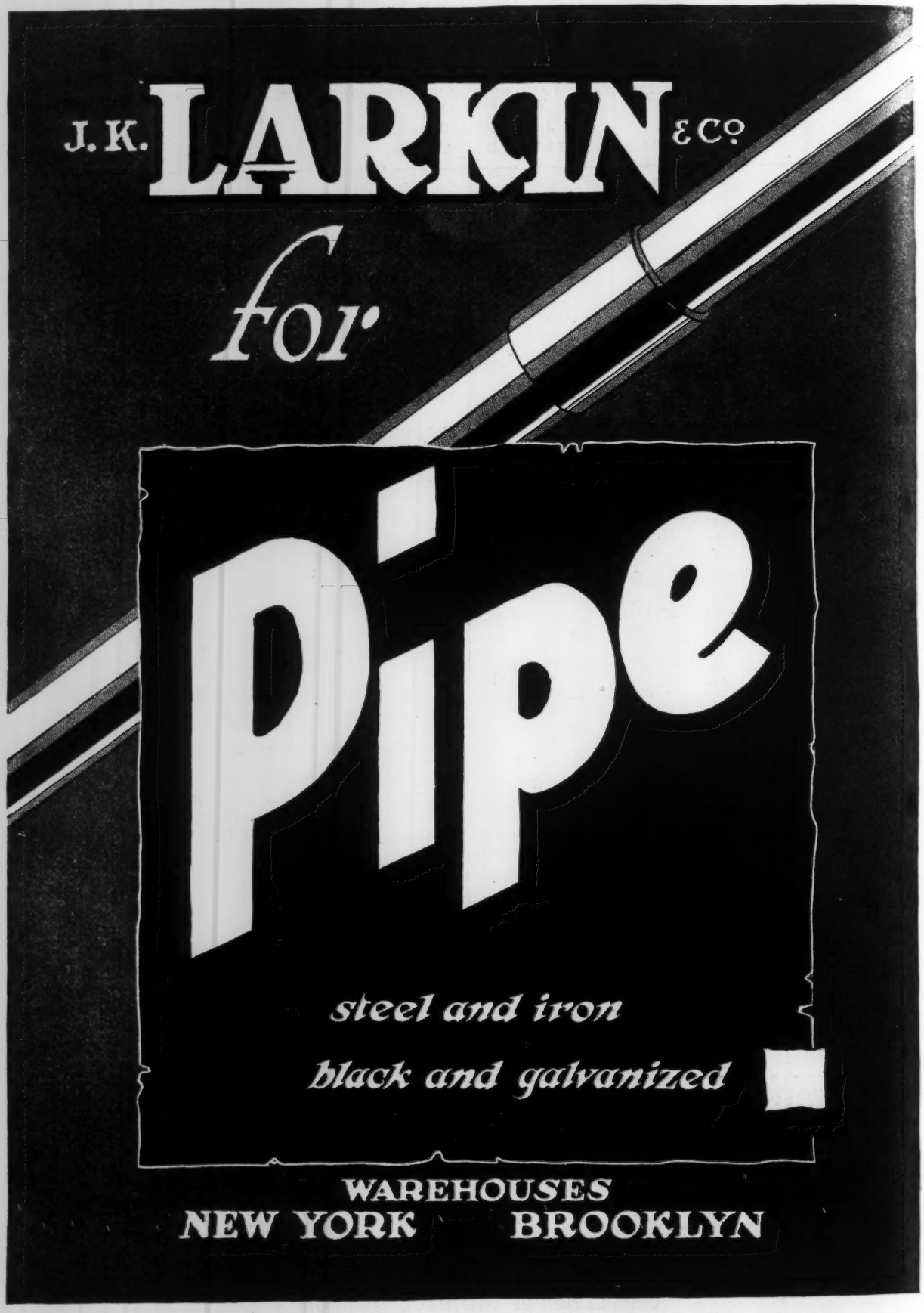
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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

Volume 81 — NEW YORK, THURSDAY, JULY 18, 1918 — Number 3

Who Will Save the Contractor?

ELSEWHERE in this issue is editorial comment on the hard position in which the freight rate increases have put the public-works contractors. This recalls the indifference of government agencies toward the contracting industry. In the War Industries Board we find a section on conversion. With the greatest solicitude, it is trying to find war occupations for peace industries —and is succeeding admirably. But of the contractor it knows nothing. The nearest sentiment to solicitude for him is in the section of the board which recommends the placing of contracts and whose cheerful word is that the contractor must go out of business. No looking to the future. No survey of possible future need for contracting organizations. No thought as to ways of conserving for the country the great investment represented by the experience of contractors. Possibly a careful scrutiny would disclose no hope. To assume that such would be the result savors, however, of the guesswork conduct of business whose futility the war has revealed. What about hydroelectric development if the pending bill becomes law; what of highway work, railroad work and concrete ships—all war measures, all likely to reach goodly proportions under a matured, vigorous, win-the-war policy? Whose business is it to find out whether the contracting organizations should be saved, if not that of the War Industries Board?

Are There Alternatives to Motor Trucking?

MR. WHINERY, in his letter to the editor, on p. 142 of this issue, makes the interesting suggestion that it is feasible to construct on the side of our highways a railway track or tracks to carry motor trucks fitted with flanged steel treads, so attached as not to interfere with the use of the trucks on ordinary road surfaces or city pavements. When roads were encountered that were fitted with the track system, both power and the road surfaces could be saved. We need to take a broad view of our highway transportation problem, study all the factors, reach an unassailable conclusion, and have the courage to act upon it. If some system other than transportation by motor truck over present types of highways is less expensive, the new plan must be adopted. The amount involved annually in trucking charges and road upkeep is so tremendous that even relatively small savings per mile of road or per ton-mile of traffic reach an enormous aggregate. We need to inquire, for example, into the merits of narrow-gage railways as substitutes for motor-truck transportation. Mr. Tomlin, war correspondent of the *Engineering News-Record*, in his recent articles (June 13 and 20) showed that the light railways back of the British front are carrying a tremendous traffic. They can be put down at relatively small expense and the upkeep is light. Many difficulties, of course, suggest themselves —matters of safety, legislation, finance—but the difficulties cannot be properly appraised until we get more facts. If the costs on careful investigation are shown to be low, then will be the time to consider what legislation will be necessary, what are the financial difficulties, etc. And even if this scheme and Mr. Whinery's prove to be chimerical, the close scrutiny of present methods which will result from the studies will very considerably advance our knowledge of the essentials of the most economical highway transportation scheme.

Municipally-Owned Garbage Reduction Works Increase

WASHINGTON has followed close upon Indianapolis in making the local garbage-reduction works a municipal enterprise. Still earlier, this had been done by Cleveland, Columbus, Chicago, Schenectady, Akron, and Rochester. New Orleans has a municipal plant in prospect. Other cities are sure to build or buy garbage-reduction works soon. War conditions will check the movement in some places and hasten it in others. The argument for municipal ownership is strengthened wherever for any reason authority is lacking to let disposal contracts for sufficiently long periods to warrant reasonable bids without the risk of losing invested capital by failure to secure a renewal of the contract. Broadly speaking, a reasonable garbage disposal bid in these days of high grease and tankage prices should yield the city a revenue, instead of causing it an expense—assuming that the contract does not include collection as well as disposal. As a general rule, where for any reason a city cannot embark on garbage reduction because of the high capital outlay involved, it may still insure the utilization of its garbage, and perhaps a handsome revenue, by establishing a municipal piggery or letting a contract for disposal by feeding. This is no time to burn garbage—especially where coal has to be used for the purpose.

Court's Vacation Blocks Road Improvement

HIGHWAY improvement in Indiana, long needed and fought for, is delayed for at least a year by the adjournment of the State Supreme Court for its three-month summer vacation without rendering its expected decision as to the constitutionality of the new

highway law. Delays due to such vacations have been a standing source of complaint against our judiciary system for many years. It would seem that at least in these times of stress the courts might defer their vacations in order to handle important cases. Under the new Indiana law a state highway commmission was established and active planning of a program of improvement was initiated. One of the lower state courts then held the law to be unconstitutional, and the commission was enjoined from doing any work. The case was appealed to the supreme court, and it was hoped and expected that an early decision would be given so that, if favorable, work might be carried on this season. On June 28 the court adjourned for its vacation without having taken any action in the matter. As it will not be in session again until October this puts a stop to all preparatory work and prevents even beginning construction work this season. It also results in the disorganization of the highway commission's staff and engineering force and effectually blocks Indiana's attempt to improve its public highway system. We sorely need such an organization of the engineering profession as will take cognizance of such conditions and bring the influence of the profession to bear.

Robbing Peter

WHILE the railways were under private management, rate increases were either niggardly or entirely denied. Now that the Government is operating the properties the shoe is on the other foot, and rates go up. We cannot argue against that decision. It should have been made years ago. What we do object to is its ruthlessness—instistence that the Government get its due even though others suffer grossly. We refer to the public-works contractors.

There are in existence today many contracts for road work, for example, entered into prior to the freight-rate advances. In only one or two states can the contractors be relieved. By act of the Federal Government these men, without fault of their own, must suffer serious loss; some of them may be forced into bankruptcy. That rising labor prices have also caused the contractors loss is not an extenuating argument. The one is a specific act of Government, a fiat that cannot be overcome by better management; the other a result of general conditions. The former can be relieved by instant action of the Government; the latter cannot. The raising of rates, so far as it affects many public-works contractors, runs counter, too, to the Government's general war attitude toward industry. War contracts are uniformly on a cost-plus or a limited compensation basis, the purpose being to protect the contractor against the very conditions which the Government itself now imposes on builders of public works. Moreover, the exaction of higher railroad rates is due to a desire to deal fairly with the railroad employees, while the contract between the Government and the railroad owners will insure the latter their pre-war dividends.

Somehow, the same consideration has not been shown the public-works contractor. Builders on private work can reason with the owners. Builders on public work find it useless to reason, for the owner, the public, has fortified himself with laws that force completion of the job even though it drive the contractor to bankruptcy.

Some weeks ago the railroad administration was asked to give relief to highway contractors, but refused it. Last week the matter was again brought to the attention of the railroad administration, this time on reconsideration of the road-materials rates as a whole. The case for reconsideration is regarded by rate authorities as strong. If hearings are granted the whole highway situation will come strongly before the Administration, and out of the presentation, let us hope, will come the same consideration for the highway and public-works contractor that the Government has shown its war contractors, its railroad employees, and the owners of railroad stock.

Seeking Federal Aid for a Hudson River Vehicle Tunnel

THERE is growing a belief that New York City's freight-handling problem, which has been under investigation and discussion for fully a score of years, can best be solved by building a vehicle tunnel under the North River so that the motor trucks of Manhattan merchants can receive and deliver freight at stations on the New Jersey bank of the Hudson River. Both New York and New Jersey have commissions which have long been studying the problem of bridges and tunnels but have thus far failed to develop a financially feasible scheme.

Meanwhile the relation of traffic congestion in New York to the Government's war activities is such that bills have been introduced in Congress appropriating $6,000,000 toward the cost of the projected tunnel, provided the states of New York and New Jersey will within two years each contribute $3,000,000. As neither state can take action until its legislature meets next winter and as a state appropriation of such an amount for this work would have to receive approval by a popular referendum vote before it could be effective, it will probably be nearly two years before construction of the tunnel could begin, even if no opposition is encountered. Allowing two years for construction, this would mean the lapse of four or five years before the tunnel could begin to relieve traffic congestion.

Since the traffic congestion is steadily increasing it is evident that work on the tunnel should be begun as soon as possible. It does not follow, however, that this argument will convince Congress, which may object that a work which will be available only four or five years hence should not be undertaken as a war measure. It is well known also that congressmen from many sections generally oppose Federal expenditures for the benefit of New York's commerce, even where the responsibility, as in appropriations for harbor improvement, is clearly upon the Federal Government. The opponents will have in this case the added argument that Congress in granting Federal aid to a vehicle tunnel would be establishing a precedent under which heavy drafts might hereafter be made on the Federal treasury for the construction of projected bridges and tunnels in all parts of the country, wherever such structures could be shown to be carriers of interstate traffic. All this, with the well-known difficulty of getting any legislation through Congress not directly related to the war, leads to the conclusion that New York and New Jersey should

not count on aid from the Federal treasury for this work.

The two states have now a special commission studying the port of New York, and some authoritative statement may well be looked for in its report as to the relation of the proposed tunnel to port congestion. It is to be hoped that the project may be there presented in such clear and convincing shape that the difficulties which have hitherto prevented the two states from financing the tunnel enterprise may be overcome.

Stop Chicago Water Waste

UNIVERSAL metering of all water services in Chicago in ten yearly installments seems nearer accomplishment than ever before. The finance committee of the city council has reported favorably on such an ordinance and the matter comes up today for consideration.

For many years the city engineer, who builds the works and purveys the water, and the superintendent, who handles the finances, have made strenuous, though futile, efforts in season and out to persuade the city council to adopt some metering policy to check waste and reckless consumption. At last various civic bodies have awakened to the fact that Chicago is 20 years behind the times in its sale methods.

Perhaps the emphasis of the war on the need of public economies has crystallized the opinion that now is the time for Chicago to "confess conversion," face about and abandon the policy of needlessly burning 100,000 tons of coal a year, building a new pumping station without getting any appreciable benefit and pumping more water than any other city in the world, only to waste half of it.

Possibly the numerous arguments put forth in the report of the Bureau of Public Efficiency, an engineer's report written for lay consumption (see *Engineering News-Record*, Feb. 7, page 268) were not without effect. However, it is more likely that the real spur to action, if action is taken today, will come from mass education and mass demand from the great sweltering lower classes. Those who live in the congested districts are tiring of conditions under which they cannot get water on the second and third floors. Of this class are the constituents of a socialist alderman on the West Side who forced him to seek a solution. The water department officials welcomed the opportunity thus afforded to point out the only remedy.

Aldermen in the silk-stocking wards have always favored metering the city, while those from the congested districts were not interested, were apathetic or were violently opposed to meters, because they represented unenlightened voters who have an inherent fear of being led into something prejudicial to their interests. These are the political aspects of a strictly engineering problem and too often they control. The sooner engineers learn to analyze these controlling civic influences, to plan active campaigns of education, and to act on the plans effectively, the quicker will they be doing their full civic duty.

Already much work has been done in Chicago—good so far as it has gone. The engineers' sub-division of the Chicago Association of Commerce is responsible for aligning that body on the side of meters. Various engineering societies have passed the customary resolutions favoring water-waste elimination by metering, but none of them has made any effort to enter the political arena, where the real decision will be reached. No better opportunity exists for active participation in a clear-cut case on which all can agree. Engineers should get into the fight. It is a righteous cause.

Centralization of Educational Functions of War Department

ALL the educational functions of the War Department carried on with the coöperation of educational institutions have been centralized. Under an order dated June 28, the Committee on Education and Special Training will have direction not only of courses for mechanics and of the training of college students, but will supervise furloughing and enlistment in the technical students' Enlisted Reserve Corps, and represent the War Department in its relations with educational institutions. It was a consummation devoutly to be wished.

As was set forth in this journal some months ago, we were facing confusion in these matters. Medical students had been given a furloughed status and efforts were being made to secure somewhat similar rulings for other classes. There were differences in the requests being made. At the same time the Federal Board for Vocational Education was pressing to take over the mechanics' training work, while there was utter neglect of planning for the military instruction of the ripening officer material, the boys in college. Happily wise counsel prevailed. Instead of experiments in separated control, the efforts have been headed in one direction, culminating in the order of June 28.

It should be noted that this order settles definitely and satisfactorily the military control of students whether engineering or otherwise. It does what Dean Richards of the University of Illinois contended for—allows the board to hold all promising men in school.

Simultaneously with the new order details are published of the regulations governing the new Students' Army Training Corps. The corps is a most promising addition to our army organization and our educational system. He fails to appreciate the disciplinary and physical achievements of the National Army camps who entertains the thought that this corps, established as a war measure, will be dropped after the war.

Fortunately the work of the committee so far assures a vigorous and broad handling of the new corps and, as well, of the broadened duties. During its brief existence it has so ably handled its assignments that 40,000 men detailed from the army are now in school receiving intensive mechanical instruction. The development to date of plans for the new corps is its work, while in the mechanics' instruction its broad grasp is shown by the institution of courses on the causes of the war and our aims in entering it. Each of the soldiers in these schools will go out as a missionary fortified with correct views on the reasons for our participation in the war.

The committee and its civilian advisory board are to be heartily congratulated on their progress and on the confidence reposed in them in the enlargement of their duties.

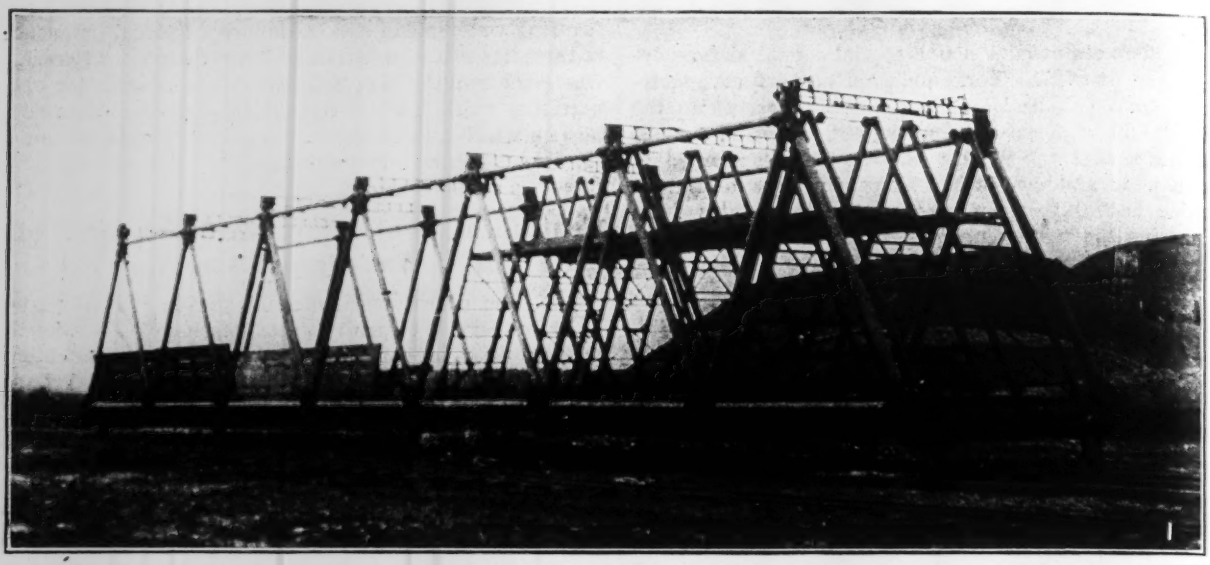


FIG. 1. HEAVY TYPE OF PORTABLE STEEL BRIDGE—RESEMBLES LIGHTER STRUCTURE SHOWN IN FIGS. 5 TO 11

Army Engineer School in France Standardizes Work in the Field

Gives Courses of Training to Men Recommended for Commissions—Operations Conducted Mostly in the Open—Classes Trained in Mining, Pioneering, Bridging, Topography, Camouflage, Sound Ranging and Interpretation of Aërial Photographs—Model Battle Sector Laid Out and Completely Equipped

BY ROBERT K. TOMLIN, JR.
War Correspondent of Engineering News-Record
All Photos by Engineering News-Record

TO SUBSTITUTE standardization for improvisation in the conduct of military engineering operations, in both field and office, and to give the man in the ranks an opportunity of becoming a commissioned officer, are the two main objects of the Army engineer school of the American Expeditionary Forces in France, which was formally inaugurated Apr. 1 with a class of 110 enlisted men from various technical units. This school is, in effect, a super-Plattsburg, where facilities for instructing our men in the latest phases of military engineering practice are being mobilized.

The need for such training is great, for many of the standards of practice laid down in former engineering field manuals have either become entirely obsolete or need substantial revision to bring them up to date; and, in addition, there is a host of new phases of the work of the engineer under the conditions of modern warfare. For example, the latest methods in the erection of barbed wire entanglements, the location and construction of trenches, the excavation of dugouts by rock tunneling, the interpretation of aërial photographs, the registering of enemy batteries by sound and flash ranging, the detection of enemy sapping operations by microphone, the rapid assembly and launching of new types of bridges, measures for gas offense and defense, the location and protection of machine-gun emplacements, the camouflaging of gun positions—these and scores of other subjects go to make up the curriculum of our newly established overseas engineer school.

Where training camps in the United States gave candidates for engineer commissions a grounding in the duties of the engineer service, the work at the school here on French soil begins where the others terminate, corresponding to a postgraduate course for commissioned officers and an intensive period of instruction for noncommissioned officers aspiring to higher rank. Just as the air-pilot candidate who has become proficient in straight flying must master the "circus stunts" which are an essential part of modern aërial combat, so must the Army engineer's education be topped off with a course in the less sensational, but equally specialized, phases of the new military engineering which the war has developed.

HOW COURSES ARE CONDUCTED

It was my good fortune to be present at the opening of the American Army Engineer School over here and spend the day in an inspection trip with its commandant, a colonel of engineers well known readers of this journal by reason of his series of articles on the engineer in war which appeared in *Engineering Record* about two years ago. I say "an inspection trip," for the school's work is not all done within the four walls of the classroom which we generally associate with the word "school." This engineer school conducts the greater part of its operations in the open, by means of practical demonstrations, and to cover its field of activities Colonel B—— and I started out in the morning and

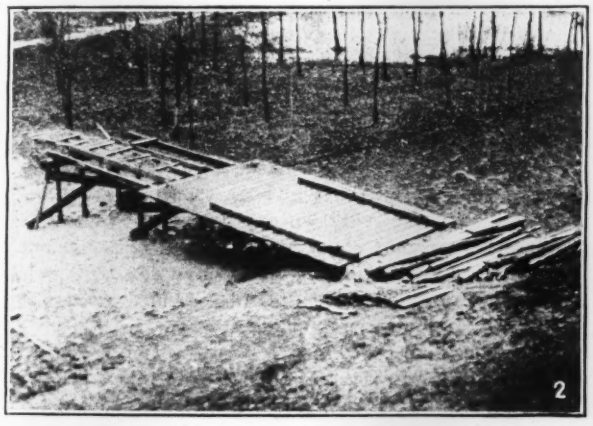
traveled over many miles of French highway by automobile before we got back to his headquarters late that afternoon. Of course, it must not be supposed that classroom work and lectures are omitted from the curriculum. The indoor work is an important part of the course, for, in addition to lectures by our own officers, candidates have the opportunity of attending conferences conducted by specially selected men from the forces of our allies, so that the experiences of those who have been playing the war game for a longer period than we have are made available for our use.

Training Covers Many Specialties

The school of "military engineering" is departmentalized under three main subdivisions, as follows: (1) mining; (2) pioneering and (3) bridging. Closely allied with the so-called military engineering courses are six others covering the fields of camouflage, flash and sound ranging, topography, mapmaking and the interpretation of aërial photographs; orientation (artillery) and, finally, gas attack and defense. From the nature of things and the constantly increasing number of American troops in France, it is not possible to give every officer a course at the engineer school. Nevertheless, selected men are sent to the school for a period of training and are then available as instructors either in the corps schools or in their own organizations, to pass along to their fellow officers the knowledge they have acquired. This applies to the men with commissions now.

In the case of the man in the ranks who is found deserving of promotion the mode of procedure is thus: A regimental commander of engineer troops is authorized to recommend for promotion a certain small percentage of his enlisted strength. On reports from his battalion and company commanders he chooses certain men, generally corporals or sergeants, whose work has been of a high order and who, it is thought, have the qualifications of commissioned officers. These specially recommended men are then temporarily detached from their own organizations and sent to the engineer school for a course of instruction. Their work is carefully watched, they receive examinations of one kind and another, and, if the tests are passed successfully, they receive their promotions. The future policy, I was informed, will be to draw largely upon the ranks for all new commissioned officers in the engineer service.

It is not necessary for every engineer officer or candidate for a commission to take all of the courses previously noted. The idea is to produce a supply of specialists for each branch of the service. Certain courses, however, are obligatory, no matter what particular duty is to be performed later in actual field service. Among these is the course in gas defense. Nowadays, with the tremendous increase in the use of gas shells, rather than the gas-cloud form of attack, regions very far back from the front lines are never safe, and it is considered absolutely necessary that our engineer officers and men be thoroughly versed in the measures of gas defense. All officers on their way to the front, therefore, must either pass directly through the gas school, or else re-



FIGS. 2 TO 4. AT ONE OF THE FIELDS OF THE ARMY ENGINEER SCHOOL MANY DIFFERENT TYPES OF PARTIALLY COMPLETED WOODEN BRIDGES ARE AVAILABLE FOR STUDY BY STUDENTS. IN FIG. 4 NOTE PARTICULARLY THE FORM OF ABUTMENT, WHICH CONSISTS OF CUBES OF STRUCTURAL STEEL BUILT UP LIKE BLOCKS

ceive instruction at the hands of graduates of the school. During the time of my visit an experimental field was being prepared for gas work, both defensive and offensive, to take the place of a wooden gas hut located in the courtyard of the engineer school, which had been used principally to test the adjustment of gas masks. One of the chief functions of the gas school is to qualify men to act later in the capacity of instructors for their own units. For instance, a group of prospective division gas officers will arrive at the school, the commandant having been previously directed to "give them a week of gas." With the new facilities for instruction at the experimental gas field, both this work and offensive training can be readily handled. The week's course enables the men to go back to their organizations well equipped to take charge of all defensive gas instruction. The offensive course is longer and more elaborate and is not of universal application.

Model Battle Sector

In order to make the instruction as practical as possible a certain area of selected ground has been marked off as a battle sector for a division, and is being developed exactly as it would be if it were part of the front. In this sector one sees trenches in various stages of completion; dugouts just begun, with entrances finished, and finally with all underground passages excavated; machine gun emplacements; trench mortar batteries properly located; barbed wire entanglements of several different types; various exhibitions of camouflage work, and so on through the entire category of defensive and offensive measures. All of these works represent the efforts of students at the school. However, one man is not kept at trench digging day after day. He puts in a certain number of hours, let us say, on excavation, then he passes along to the point where revetment work is needed, and works there awhile. His next task may have to do with trench drainage, and after that with barbed wire entanglements, and finally with the more complex structures, such as observation posts, machine gun emplacements, and the like. And so it is with the dugouts. Successive groups of men each do a little work on each type of structure in each stage of the work—enough to familiarize themselves with the actual construction methods—and then pass on to something else.

"The principal idea of the school," Colonel B—— explained, "is to capitalize for war purposes American genius for quantity production. We have before us as an example our achievements in the quantity production of automobiles. Such results are possible only by standardizing parts and operations. We are trying to carry this principle into the work of the Army engineer school. We are trying to develop standard methods of building trenches, dugouts, bridges, machine gun emplacements and all of the other works needed at the front. Of course I appreciate fully that many cases will arise where our standards must be scrapped and where we will have to improvise, and improvise quickly. Nevertheless, the standards we are developing will be good at least seven times out of ten. A man must use his own judgment in departing from the routine way of doing things. In the development of our field engineering methods, however, we are combining our own ideas with the best experience of our allies, and are evolving a standard practice which will, I think, be a big factor in saving time at the front—and time is the all-important element these days.

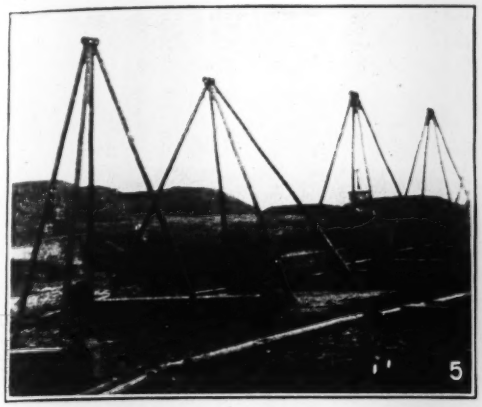
"Take the matter of dugouts and underground passages, for example. We have a set of standard casings or mining timbers which we are teaching the men at the school to use. When they get out into actual service they won't have to spend time devising a scheme of timbering for a tunnel. All that is done beforehand, and their job will be almost automatic, using the methods and material with which they have become familiar here at the engineer school. The same thing applies to bridge work and to what we call "pioneer' work; that is, trenches, obstacles, etc. We think we are now in a position to say what is the best way of doing all these things, and it is this 'best way' that we are making standard and driving home to the men by means of our recitations, demonstrations and actual work in the field by students."

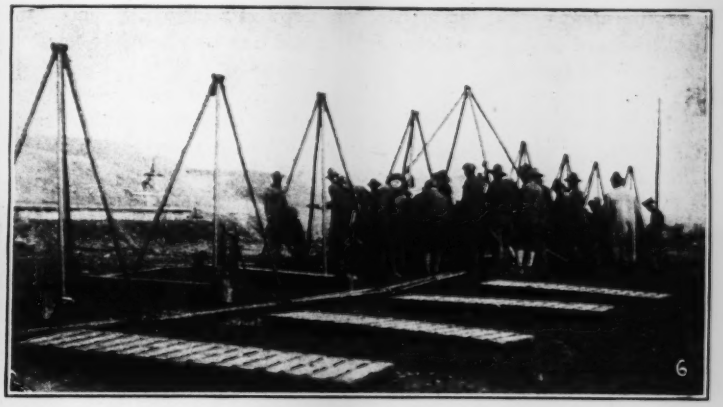
Bridge Built in Eight Minutes

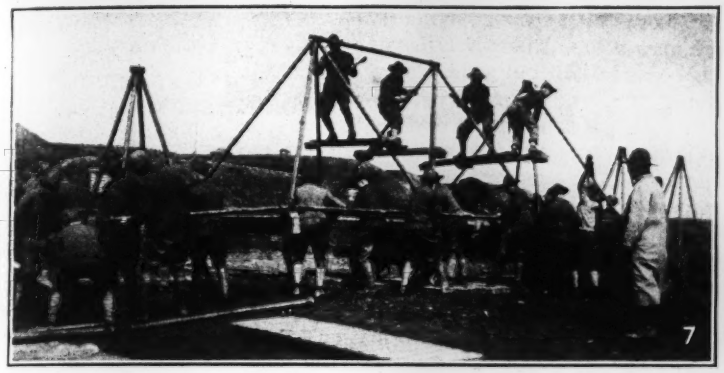
On the inspection trip of the field work of the engineer school our first stop was at a point where instruction in bridging was in progress. In addition to pontoon bridges, a number of other types of structure, both wood and steel, were in various stages of completion. There were the heavy steel portable bridge made of steel tubing, Fig. 1, and wooden bridges and trestles as shown in Figs. 2, 3 and 4. In Fig. 4 the abutment should be particularly noted. It is made up of individual cubes of structural steel shapes piled one on top of the other like a child's building blocks. This form of abutment is of British origin, as is also the demountable bridge shown in Fig. 1. The bridges in Figs. 1 to 4, inclusive, serve as models which are first studied and then built by the students at the school.

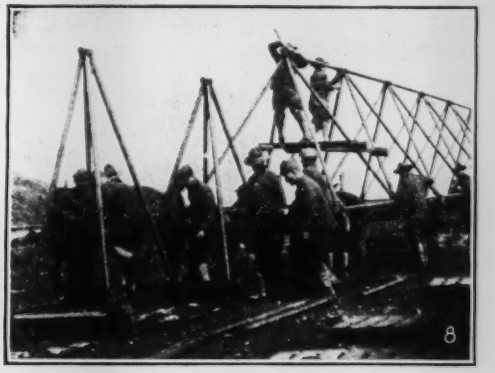
Following the same design as the bridge in Fig. 1 is another, much lighter, which is especially adapted to conditions where very speedy work is required—in crossing a river or canal under shell fire, for example. This is the light Inglis portable bridge (British), which is made up of sections of drawn or welded steel tubing, with special pin-connected joints. The bays are 8 ft. long. The parts of this bridge were placed along the ground parallel to the moat of an old French fort when we arrived. "If you want to see how we handle this work," said Colonel B——, "I'll have them set up this bridge and launch it for you." I certainly did want to see such an exhibition; so the colonel summoned the lieutenant in charge of a detail of 34 men and gave orders for the erection of the bridge. I had my camera with me and the resulting photographs, Figs. 5, 6, 7, 8, 9, 10 and 11, will indicate more clearly than words what happened.

Just a few words of explanation, however, are necessary. The method is to erect the bridge on the ground parallel to the watercourse, swing it around through an angle of 90° and run it forward as a cantilever over the moat. It will be noted that the structure is mounted on a two-wheel truck, or "dolly," which makes the launching operation very simple, and that the rear end where the men are assembled, as shown in Fig. 10, is counterweighted. When the far end of the bridge rests









Building a Bridge in 11½ Minutes

FIG. 5. BEFORE ERECTION AND LAUNCHING, PARTS OF THE LIGHT PORTABLE BRIDGE ARE LAID OUT ON THE GROUND PARALLEL TO LINE OF STREAM TO BE CROSSED

FIG. 6. AT ORDERS FROM COMMANDING OFFICERS MEN OF BRIDGE BUILDING COMPANY START THE WORK OF ERECTION

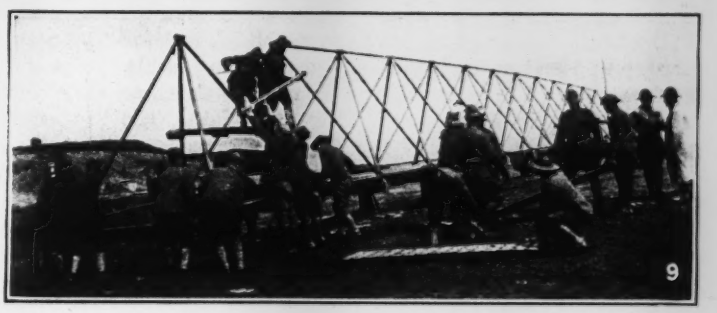
FIG. 7. THE FIRST BENT ERECTED AT ABOUT MIDDLE OF STRUCTURE, DIRECTLY OVER TWO-WHEEL TRUCK USED LATER FOR LAUNCHING

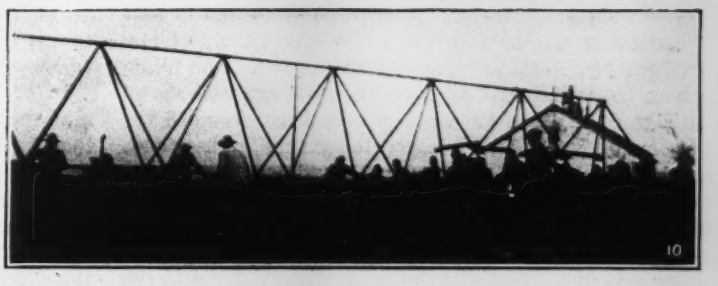
FIG. 8. BY THIS TIME A CONSIDERABLE LENGTH OF BRIDGE HAS BEEN SET UP—NOTE BOTTOM-CHORD MEMBERS LYING ON GROUND AND POSITION OF JOINTS AT BASE OF FOUR-LEGGED SECTIONS

FIG. 9. FINISHING ERECTION OF LAST BENT—NOTE POSITION OF MEN, EACH HAVING SPECIFIC PLACE TO OCCUPY AT SPECIFIC TIME

FIG. 10. ERECTION HAS BEEN COMPLETED AND BRIDGE IS BEING SWUNG ROUND AND RUN FORWARD ON TWO-WHEEL TRUCK LOCATED JUST TO LEFT OF OFFICER IN LIGHT RAINCOAT

FIG. 11. BRIDGE LAUNCHED ACROSS MOAT OF OLD FRENCH FORTRESS AND IN PLACE ON ITS ABUTMENTS





on its abutment across the stream the dolly is removed, the extra bays at the counterweighted end are knocked down, and the near end is seated on its abutment. With these bridges it is, of course, the practice, for the launching operation, to construct a greater length of bridge than is ultimately placed in service. In the present case 104 ft. of bridge was erected to give an ultimate useful span of 56 ft. It is practicable, however, to place the bridge in position by means of a derrick on the far side without cantilevering. This latter method is slower than the cantilever method, but allows the launching of a longer span.

Here is how the work progressed on the bridge I saw erected and launched: Thirteen bays, each 8 ft., or a total of 104 ft. of bridge, were erected in 5 min. 10 sec. The launching required 1 min. 20 sec. The removal of the "dolly" took 50 sec. In 4 min. 10 sec. more the counterweights had been removed, the extra launching bays had been knocked down, and the bridge was ready for service. In other words, exactly 11 min. 30 sec. was consumed in the entire operation.

I have just received a note from Colonel B—— saying that on May 4 his men cut the time of this whole operation to 7 min. 50 sec. The erection of the bridge proper required only 4 min. 12 sec., nearly a minute better than the time made the day I saw the bridge-building demonstration.

64 Pounds per Foot of Span

This type of light portable bridge weighs 63.75 lb. per foot of span, and can be used for spans as great as 96 ft. when launched by the cantilever method, and for spans up to 120 ft. when launched by derrick and tackle. The flooring consists of portable wooden sections such as those shown in the foreground of Figs. 6 and 10. The bridge is intended primarily for the use of troops on foot, although horses are occasionally carried by it. In the latter case, I was told, the practice is to use canvas sheets stretched on siderails to cover up the openings in the floor and sides; otherwise the horses become frightened and it is difficult to get them across the structure.

The principal feature of this portable bridge is that it can be assembled and launched without tools of any sort, except several small spanner wrenches. The joints are an important part of the design and are well shown in Figs 6, 7, 8 and 9. Note also in Figs. 6 and 8 the bottom-chord members lying on the ground. Their ends are held fast, as are the ends of all the chord and web members of the bridge, when in position, by pins which extend through the holes shown. There is a steel tongue welded into each end of each tube, and provided with a screw and nut. To make the connection, the nut is run back on the screw, and the tongue inserted into the joint-box. The pin is passed through the hole in the tongue and through the pear-shaped slots in the sides of the joint-box. The nut is then screwed up, causing the tongue to draw out of the box until further movement is resisted by the pin. To prevent these pins from being lost they are attached to the joint blocks by short lengths of chain.

The heaviest single member of the bridge proper (except the transom) weighs but 56 lb. To attain speed in the assembling and launching of this bridge it is essential that each member of the crew have a specific job to perform, and that the sequence of operations, by reason of repeated performances, shall become practically automatic. The heavy bridge in Fig. 1, which will carry the heaviest of military loads, has a joint scheme similar to that described above for the light bridge.

Dugout Construction and Mine Warfare

From the bridge work we proceeded to the model "front," where the school's members were busy on dugout construction, barbed wire entanglements, trench digging and other activities. The school's battle sector is underlaid with rock, so that the dugout work was a regular hard-rock tunneling job. The entrances to two of these underground works are shown in Figs. 12 and 13. They assume the form of inclines extending to such depth that they have about 25 ft. of head cover over the roof where a horizontal passage begins. The incline was timbered solid with standard mining sets. Excavation required rock drilling with jackhamers fed by hose from a compressor driven by a gasoline engine. This plant was mounted on a steel frame so that it could be placed on a motor truck and moved from place to place. Blasting was done with light charges of explosives.

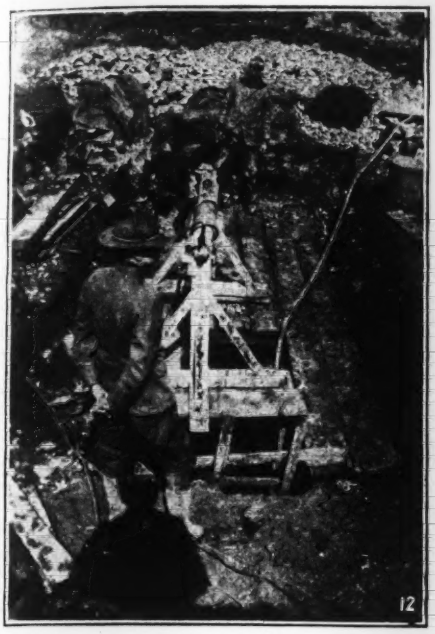
In addition to the construction of dugouts and shelters the course of instruction given by the mining section includes the principles of mine warfare and the subject of demolitions. In mine warfare it is necessary to gain information regarding the location and progress of the enemy's underground work, and in that way be in a position to forestall his plans of attack, or by noting a defect in his defensive system take advantage, for offensive action, of his weak points. To ascertain the enemy's underground positions it is necessary to employ very sensitive listening apparatus which greatly intensifies the sounds made in the rock during the progress of the work. By noting at different points the directions from which these sounds appear to come, it is possible by means of triangulation to locate the enemy's workings quite accurately.

The mining section is equipped with a listening circle and galleries where detailed instruction is given in the art of listening. The students are then given a practical course in actual listening and plotting of results, after which their papers are corrected and graded.

In connection with the listening work a course of mine rescue is given by the mining section, in which the students are required to wear oxygen helmets and are taught the methods employed in rescuing men who have become casualties in underground warfare. In addition to these subjects practical instruction is given in the employment of different kinds of explosives in the execution of military demolition.

Wire-Entanglement Work

In front of the dugouts were the barbed wire barriers. One of the most effective types consisted of circular hoops of stiff plain wire connected by strands of barbed wire, forming an obstruction that looked like an elongated squirrel cage, except that diagonal strands crisscrossing from one hoop to another blocked up the cylindrical longitudinal opening. This form of obstruction is made up in 20-ft. lengths behind the lines, and before it is placed in position, it is packed close like a



FIGS. 12 AND 13. THESE ARE THE ENTRANCES TO TWO MODEL DUGOUTS WHICH STUDENTS AT THE ARMY ENGINEER SCHOOL ARE EXCAVATING IN ROCK

coil of wire rope. It is then carried forward and opened out like the bellows of an accordion.

Iron stakes, of the screw type, are used to hold the framing hoops upright. These screw stakes, or pickets, possess an advantage over stakes that must be driven with a mallet, in that they can be set noiselessly. This is a very important feature when working in No Man's Land.

Other types of wire obstacles are constructed in advantageous locations by the students. There are regular drills for the erection of these various forms of entanglement, a certain crew being assigned to a definite length of obstacle. Each man of the crew has certain definite tasks, which he goes at in turn, so that the placing of a stretch of wire is like a silent game.

Further along we find a real front-line fire trench—this standard trench as well as the barbed wire entanglements being the work of the pioneer section. It is laid out to conform to the requirements of the ground. In this trench are all types of standard revetment, supporting the sides, there being several fire bays in each type. A real observation post has been put in, so cunningly concealed that it is impossible to detect it from the enemy's side. The drainage of trenches is always a problem—and here it is well worked out, so that the students can get real practice for use later when they are in charge of sectors at the front.

The tracing of trenches is worked out in this sector by the students, both in the daytime and at night. To be ready to do this work quickly and noiselessly when under the observation of the enemy takes much practice, and it is of the utmost importance that an officer should know just how to go about it. The method of placing a working party on the job is also practiced, after the trace of the new trenches has been laid down.

Under "pioneering" come also the construction and maintenance of roads, always one of the most vital problems with which military engineers have to deal, and there are at present at the school roads in every stage of construction, from the preliminary excavation to the completed product.

A light railway connects the front line with the rear of this "battle sector." When one sees the immense amount of rock and gravel that has been hauled over its rails, one realizes how important is the construction of such means of transportation at the front, and here again the student gets that practical instruction which is the only adequate training to prepare men for actual service in the field.

The conferences of the pioneer section not only prepare the students for outdoor work in field fortification, construction of roads and communications and light railways, but also take up in detail the study of French maps, billeting, construction of various types of huts, and layout of water-supply systems.

To see a class of fifty students earnestly studying a map to discover the best position for a strong point is to convince oneself that they mean business. This map study is of the greatest value, because an officer must be able to orient himself quickly on the ground and—with the aid of his map—know exactly how to lay out and hold his position.

Billeting was a new proposition to our Army when it came to France, and it really requires considerable study. Conferences of the pioneer section study this subject in detail, as well as methods of constructing huts when billets are not available.

(To be concluded)

Denver Getting Ready to Buy Water-Works

Purchase of the property of the Denver Union Water Co. by the City of Denver, which has been under consideration for a long time, has been brought a step nearer by the approval, by the Capital Issues Committee, of a bond issue of $13,970,000. The water company has agreed to accept the bonds in lieu of cash. It is expected that a bond issue election will be held as soon as it can be provided for.

New Contract System Which Stimulates Efficiency Gaining Favor

Method Might Replace Lump Sum, Percentage and Bidding on Fee, Shifting Risks to Owner and Making Certain Contractor Will Devote Best Efforts to Work

By Henry D. Hammond
Managing Editor, Engineering News-Record

BASED on the fact that anyone who takes a construction contract will carry it out to the best of his ability if the possibility of his obtaining further work and the size of the reward which he can demand for it depend on his establishing a reputation for doing work that is satisfactory to his client at the lowest possible cost, a new way of doing business between private owners and contractors has sprung up in this country. The superiority of this method, which discards the lump-sum and unit-price forms of contract in favor of the percentage form, has long been demonstrated abroad. It owes its superiority, however, to the fact that its workings differ as widely from those of the percentage contract, as commonly understood, and as applied at present on Government work, as they differ from those of the lump-sum or unit-price contract system.

The new system, on which has been built the business of many of the largest and most successful general contracting firms of this country, promotes efficiency because the contractor finds it possible to obtain more business and charge a higher rate of return on this business directly in proportion to his reputation for doing work quickly and efficiently. To make the system effective the owner must show complete confidence in the ability and intention of the contractor to deliver the structure which the owner desires at the lowest cost. The owner has this confidence both because the contractor has shown such ability on previous work, either for the same owner or for others to whom the owner can refer, and because the latter knows that should the contractor fail in point of cost, quality or time in meeting the requirements of the work the contractor would lose his reputation and be unable to obtain further business.

Owner Assumes the Risks

As the system employs the percentage or fee form of contract, the owner assumes the risks which are thrown on the contractor by the lump-sum form of agreement, and the latter is left free to devote his entire energy to completing the work in the most efficient manner. As the contractor is able to capitalize efficient work by getting a larger volume of business and charging a higher rate of return, his interest becomes one with that of the owner and the engineer in producing a structure which completely satisfies the requirements laid down in the contract. As a result, the system eliminates the expense of double control of the work and duplicate checking of all the contractor's operations. Moreover, it eliminates the large risk which the contractor assumes under a lump-sum contract in the interpretation placed on the specifications by the owner's engineer. For no matter what this interpretation may be, the owner is paying for the work done and the contractor is devoting his undivided attention to delivering it as directed. It may be said, then, that three things differentiate the system from percentage contracts as generally understood in this country: First, the intention of the owner to select the contractor on the basis of past efficiency, and to leave to him the carrying out of the work just as its design is left to the engineer. Second, this can be safely done in spite of the percentage form of contract, because, should the contractor fail in point of cost, time or quality to meet the requirements of the work, he would injure his reputation, and diminish his chances of obtaining future business and his ability to secure higher returns. Third, the system stimulates the distribution of the returns earned by the contractor through bonuses and increased wages among the working force, in the effort to build up the most efficient possible organization.

It is because the incentive of private profit which is the distinctive feature of the lump sum contract is absent in the percentage contract that the latter form of agreement is justly considered a dangerous one, which if persisted in will destroy the morale of the construction force, prevent the development of new methods and, finally, result in stagnation.

Employees Benefit by Plan

The critics of the system, which is gaining favor among private owners and contractors, however, make the mistake of assuming that there can be no motive for the improvement of methods or efficiency except the one of financial advantage to the proprietors of the construction firm. As a matter of fact, this motive, which is admittedly supplied by the lump sum contract system of competitive bidding, leaves much to be desired. It is partial in operation, impelling to action only the owners of the contracting enterprise. It cannot be expanded to the working force except through voluntary action on the part of these owners, and is rarely in practice so extended. The new contract system, however, supplies the motive of personal gain all along the line from the proprietors to the last laborer, through high rates of pay to efficient crews and bonuses for keeping the work within the estimates of time and cost.

This may seem a startling claim for any form of contract under which the owner of the structure being built pays all the bills and in addition gives the contractor an additional fee, whether fixed or a percentage of the total cost, for his experience and services. The entire contradiction, however, vanishes under scrutiny of the system in operation.

The contractor has to sell, besides the labor and materials which go into his work and the use of his equipment and capital, a definite, tangible thing. It is difficult to describe; but it may be outlined as his experi-

ence and ability and his reputation for using labor and materials to produce good work at the lowest attainable cost. Under the lump sum form of contract, there is no direct recognition of the fact that this thing is bought or sold. The contractor must take his chances of being compensated for it, and he receives payment for it only when he succeeds in accomplishing the work specific under the contract for less than he has led the owner to believe that it would cost. This compensation is known as profit. It extends only to the owners of the contracting enterprise. It is understood that the contractor is entitled to it, but from it must be deducted all expenses due to the risks involved in the work. These include damage and delay to the work from natural causes, changes of mind on the part of the owner, and expenses due to a lack of exact understanding between the contractor and the engineer—a thing bound to occur in some degree on every contract. There is always present the temptation to add to the contractor's profit by lowering the quality of the work performed, with no check upon it except the vigilance of the owner and his engineer. The exercise of this vigilance necessarily produces constant friction.

The percentage and fee forms of contract recognize this thing which the contractor has to sell, and fix a compensation for it. In so doing, they properly transfer the normal construction risk from the contractor to the owner. They also remove the cause of friction between the engineer and the contractor by making it impossible for the latter to affect the total compensation for his services by reducing the quality of the work. At the same time these forms of contract make it impossible for the contractor to affect the amount of compensation for his services by improving his methods and increasing his efficiency, and therefore they are justly considered failures.

System Improved in This Country

The actual form of contract used in this country under the new system usually includes time and cost penalty and bonus provisions which make it possible for the contractor to affect directly his compensation on the individual job. This, however, is an improvement which appears to have been grafted on the original system as commonly employed in Europe, where the experience, ability and reputation of the contracting firm are evaluated at so much on each new contract it undertakes, and paid for as such regardless of the cost of the work. In operation this system makes it inevitable that the contractor's efforts will have a profound effect on his reward. If the contractor does not maintain his reputation for doing good work engineers will not engage him. Thus he is put out of business and his returns cease, as he has nothing left to sell. If he lacks experience it is impossible for him to get work except by associating himself for a time with contractors who already have reputations. In practice this has not prevented a sufficient number of new firms from being established, and all public engineers have at one time or another wished heartily that there were some way of keeping out of the contracting field men wholly without experience. If the contractor does not possess ability to carry out work efficiently, if he does not develop new methods and does not improve the quality of his service, he cannot obtain an increasing price for it on succeeding jobs; and if he actually recedes in ability and suffers in reputation, he must expect a smaller return, and in a short time will be unable to obtain work.

In order to do his work better than the next man, and obtain an increasing volume of it on which to realize increasing returns, the contractor employs the best men that he can find. They contribute to his business by lowering the cost of his work, and he is able to pay them more by demonstrating to each succeeding owner that they are worth it. In this way the increasing rewards which can be won by the progressive contractor under the system are distributed all down the line instead of being concentrated in the hands of only those persons who have invested capital in the business. For a superintendent who has done a particular piece of work for 10% less than the original estimate, the contractor can easily ask and secure a large increase on the next job. In the same way, if he has an efficient crew of riggers or pipe fitters, the contractor can easily show his client from the cost sheets of past work that these men are worth more than prevailing rates. Not only is it possible for the contractor to do this, but it is the most natural thing for him to do under the system, because it is to his immediate interest to build up and hold the best organization that he can obtain.

Competitive Bidding Unsatisfactory

Under the system of competitive bidding contracting is a hand to mouth game. There is nothing to prevent persons without experience or organization, but who can secure financial backing, from stepping in and taking work from reputable contractors at figures that are too low to compensate for the work performed. As a matter of fact, just this happens every time some new class of construction gains the reputation of being profitable. Where it becomes known that large returns have been made in the past, bonding companies and banks are willing to back anyone entering the field. A few years ago this condition developed on state highway work throughout the country, and it was not equalized until the public and the reputable contractors had suffered severely and many would-be contractors with their backers had sustained heavy losses.

Under the new system the contractor is assured of work in normal times so long as he maintains his reputation. The business-getting methods employed are simple and eliminate all motives for disguising costs. The contractor estimates the work on the information which the engineer has available, just as in competitive bidding, and tells the owner the limits within which the construction cost, including overhead, will fall under his management, and sets a price, either a lump sum or a percentage of the cost of the work, on his own experience and ability to carry out the work.

Where the value to the owner of the completed structure is great, as is frequently the case, and a saving of time will warrant additional construction expense, this factor is considered in estimating the work.

It will thus be seen that the contractor's success under this system, both in procuring work and in building up the rate of return to himself and his organization, depends absolutely on his ability. If a contractor cannot progress, cannot build up and strengthen his organiza-

tion, he cannot hope to expand his business under this system. If he cannot hold him own with the field, it will be impossible for him even to remain in business.

There are many legal difficulties in the way of adopting such a system on public work, besides the great political difficulty of obtaining as good management by Government bodies which supervise construction work as there is by private enterprises which require new building. At the present time, however, the Government of the United States has swept away legal difficulties, has neutralized to a considerable extent political difficulties, and has awarded not only construction work, but contracts for the production of all sorts of materials and implements of war, on a percentage basis.

It would be an easy matter to convert this percentage system to the one outlined here. The Government has already set up machinery for evaluating the reputation and ability of construction contractors, munition makers and others who furnish the Government with supplies. It could well go a step further, use this machinery in measuring the performance of these contractors on the work which they have, award future work on the basis of this information, discard the present double-control system and trust the contractor to deliver the work. The Gordian knot of illegality has already been cut, and there is no reason why we should not go beyond the percentage system and institute really efficient methods.

Would Stimulate Production

Not only would the system stimulate production efficiency on all Government contracts, but it would throw a new light on all questions of difference between capital and labor over the division of the rewards. For there would be no profits to the owners which could possibly be increased or decreased at the expense of labor or by manipulation. The owners and managers would be paid for their services, skill and resources a just figure which had been publicly fixed after considering all the facts, and which would be subject to variation only as they proved themselves more or less efficient than they had originally been judged to be. Moreover, it would be possible to extend the increased rewards for efficiency to the working force through action of the management, with the sanction of the Government, which would be warranted by definite facts and figures of production. The management would have a direct incentive to pursue this course, since only in this way could it build up a more efficient force, decrease its unit cost, increase its output and secure higher returns. And the Government, confident that it controlled the contractors through its means of measuring their efficiency, could reduce its heavy expenditures under the present harassing and unproductive system of supervision and control.

Some improvement over the present methods of contracting followed by the Government must come, as the demand for it is practically universal. Everyone will admit that the system of competitive bidding cannot be relied upon to satisfy the needs of the present crisis, while the percentage and fee forms of contract, which give the contractor no immediate incentive to better and more economical work, are being assailed and have already been revoked in important cases, among which must be counted that of the Submarine Boat Corporation's contract with the Emergency Fleet Corporation. It would seem that the system which has proved so successful in Europe; which has established itself firmly after some years of trial wherever it can be legally used in this country; which furnishes an incentive to efficiency not only to the owners and managers but to the entire working force; which substitutes powerful motives to coöperation for the divergent motives which lead to constant friction under other contract forms; and which tends to stabilize business and increase production, should receive most serious consideration.

Private Industrial District in Chicago Growing

New Section Gives Company 400 Acres of Modern Warehouses and Factories with Tracks and Tractor Tunnels

A HUNDRED-ACRE area developed for manufacturing, warehouse and general industrial purposes in Chicago is the latest extension of the Central Manufacturing District, which is a private enterprise forming a feature of the city's commercial activities. This new section has a frontage of about one mile on 39th St., from the river to Western Ave., with a depth of about 1000 ft., its south side bordering on the site of what was formerly Bubbly Creek and the large freight yards of the Chicago Junction Railway.

On this new section have been built already a power station, a cold storage plant and the large combined freight station and warehouse, with 23 acres of floor space, described in *Engineering News-Record* of Feb. 28, p. 405. With the sudden development of an immense war business in material and supplies for the army, the Chicago depot of the United States Quartermaster Department recognized the advantages of this site for the new and extensive facilities required. It has leased half of the warehouse noted above and has built six large temporary one-story warehouses. It has also ordered the construction of two large six-story permanent warehouses, work on which is progressing rapidly.

Six-Story Industrial Buildings

A special development planned for this 100-acre tract is the construction of a large number of six-story buildings for manufacturing and industrial firms, which may lease a single floor or an entire building. Besides railway sidings at the ground level, these buildings will be served by a series of tunnels for electric truck and tractor service handling package freight between the several establishments and the central freight station noted above. Other tunnels will contain the water and gas mains, electric conduits, steam pipes and other utilities. Similar traffic and utility tunnels will serve the Government warehouses.

A rectangular area of about 300 acres extends to the Chicago River, which affords water transportation facilities, while railway tracks serve all the plants. The area is adjacent to the stockyards district. It was vacant land when acquired a few years ago, having been used for truck gardens, with lumber yards along the river. A separate 40-acre section south of 43rd St. and west of Lincoln Ave. was acquired later. On this is the 43rd St. Union freight station of the Chicago Junc-

tion Ry., together with large warehouses and manufacturing plants.

Most of the interior streets are private thoroughfares owned by the district. They are paved with brick, concrete and macadam, according to traffic conditions, and have concrete curbs and sidewalks, while grass parkways are provided in many cases. The district has its own street-cleaning department and gardeners. The main streets are 60 ft. wide between building lines, with paved roadways 30 ft. wide. Special attention has been given to the layout of streets, buildings, driveways and tracks, in order to secure ample light and service. Fire protection and low insurance rates are insured by fireproof construction of the buildings, wide spaces between buildings, and ample water supply with firefighting equipment. Private lines of water mains have been laid to supplement the city mains. Sewer systems have been installed, connecting with the city sewers on the boundary streets.

Buildings are of different sizes and styles to meet special requirements of the tenants. They are mainly reinforced-concrete or heavy mill-construction structures, with red face-brick or concrete surface and terra cotta trimmings. Steel-frame construction is employed for foundries and shops. Each building is located inside the limits of its lot, so as to afford light and air on all sides, and each has its own driveway and switch track. Electric elevators, plumbing, heating and electric current for light and power are provided in every case, while many of the buildings have sprinkler service.

Plans and specifications are prepared by the architectural and engineering department of the district, which also lets the contracts and supervises construction. Through the adoption of certain standards of design the district is able to purchase construction materials in large quantities, thus materially reducing the cost. Switch tracks are laid in each case before work is commenced, in order to facilitate the handling of material by the contractor.

Railway Service

Railway connections and freight service are provided by the Chicago Junction Ry. and constitute a special feature of the enterprise. A complete track system, with spurs and sidings to serve all the buildings, is operated by the Chicago Junction Ry. This road has large freight stations and yards in the vicinity and provides connections with all the trunk lines entering Chicago. It serves also the large union freight house on the river, so that freight can be handled to and from steamers or barges. Through the consolidation of less-than-carload freight, even the small shippers get the advantage of carload rates. Thus, the shipper may place separate small consignments in one car, and this will be taken to the union freight station, where the consignments will be transferred and combined in cars for separate consignees or destinations.

The management and control of the affairs of the Central Manufacturing District are in the hands of J. A. Spoor, Arthur G. Leonard and E. V. R. Thayer, as trustees. H. E. Poronto is industrial agent; F. L. S. Harman, assistant industrial agent; S. Scott Joy, architect; G. W. Hegel, chief engineer, and E. A. Bull, electrical engineer.

Eight-Year-Old Concrete Flat Slab Tested in Building

BEFORE the Western Newspaper Union reinforced-concrete building in Chicago was torn down in September, 1917, the engineering experiment station of the University of Illinois was permitted to make a load test on four panels of one of the flat-slab floors. The results of the test are given in brief in a paper at the annual meeting of the American Concrete Institute by Prof. A. N. Talbot and H. F. Gonnerman, of the University of Illinois. The floors were in panels 17 ft. 5½ in. x 19 ft. 4½ in., and were designed for a live load of 250 lb. per square foot. Tests were made in varying loads up to 913 lb. per square foot. The floor was designed for a thickness of 8½ in., but was found to measure from 7.5 to 9.8 in. Reinforcement was located as designed, except that there were an abnormal number of laps which in some critical cases gave more steel than was called for.

As a whole, the tests showed the eight-year-old building to be in good shape. The concrete, particularly, was of great strength. Prisms cut from the floor showed a compressive strength ranging from 3190 lb. per square inch to 5460 lb. per square inch., and an initial modulus of elasticity from 3,500,000 to 5,100,000 lb. per square inch. The steel proved to be high-carbon, having an average yield point by drop of beam of 63,600 lb. per square inch, and an average ultimate strength of 101,-300 pounds.

Deflections of slabs were plotted. The greatest deflection under a load of 913 lb. per square foot was 1.12 in., but the arrangement of the bars of this panel showed fewer laps than some of the others. The average deflection was considerably less. Slabs cracked in characteristic places in both upper and lower planes. Concrete strains, assuming a modulus of elasticity of 4,000,000 lb. per square inch, ranged between 3550 to 3880 lb. per square inch in the upper surface of the slab under the maximum load. Deformations of the lower part of the slab showed stresses running from 1760 to 4400 lb. Analysis of the moment, which necessarily has to be quite approximate, showed that reinforcing bars accounted for about 88% of the analytical negative moment in one direction and 92% in the other direction. Similarly, about 68% of the analytical positive moment was accounted for in one direction and 72% in the other, when the percentages for the two directions were averaged, 90% of the negative moment and 70% of the positive moment were accounted for by the stresses of the steel. The authors state that the amount of reinforcement for negative moments is on the average as much as that required for negative moments recommended by the Joint Committee. The amount of reinforcement available for positive moment was on the average about 50% greater than that required by positive moments recommended by the committee. Distribution of the reinforcement was, however, quite different from that recommended. All the slab thicknesses were somewhat lower than recommended by the committee; figuring on the extra strength of the concrete they were, however, approximately according to the specification.

How Shipyard Housing Work Is Organized and Operated

Division of Fleet Corporation Has Developed an Organization in Which Engineers Play a Large Part—Sixteen Projects Under Way

TWO departments are building houses for the Government's war workers. One, the Bureau of Industrial Housing and Transportation of the Department of Labor, has just received executive sanction and is proceeding to perfect an organization which for some months has been in the process of development, in the expectation of the recognition it has just received. The other, a part of the United States Shipping Board, has been in being for about four months and has already started construction on a number of projects. The former has had delegated to it all of the war housing; the latter takes care only of the shipyards or of plants manufacturing ship material exclusively. The two are similar in organization and methods of work, though heretofore entirely independent, but the Shipping Board's branch has progressed farther in actual construction. Its operation, therefore, indicates how the Government has gone about getting the first of the homes to take care of extra war labor.

Shipyards Get $50,000,000

Early this year it was recognized by the Emergency Fleet Corporation that provision must be made for housing the workers at the new and at the enlarged shipyards where the Government ships were being built. Accordingly, $50,000,000 was asked of Congress for that purpose and was appropriated in February. The organization of a department to expend this fund was immediately started, but the problem was entirely new and progress was slow. Plans were prepared for a number of developments, but the construction of only one, that for the Merchant Shipbuilding Corporation, at Bristol, Penn. (described in *Engineering News-Record* of Jan. 31, 1918, p. 227), was actually started up to a month or so ago. Reorganization of the department took place in April when the housing and transportation divisions of the Emergency Fleet Corporation were merged into a Division of Housing and Passenger Transportation under the direction of A. Merritt Taylor, for some years head of the Philadelphia Transit Commission and a man of broad experience in rapid transit and housing matters.

The new division is now functioning well and has approved housing projects in 16 cities, the total cost of which will absorb practically all of the $50,000,000 appropriation. It has also recommended the development of a number of other projects, estimated to cost more than $25,000,000.

The organization of the division is briefly outlined in the accompanying diagram. One section is devoted entirely to transportation matters and reports through its own officers directly to Mr. Taylor. The other section, concerned only with housing, is under the supervision of J. Willison Smith as assistant director, also reporting directly to Mr. Taylor. The two sections share a common general clerical force and an accounting and statistical department. Under Mr. Smith are two executive assistants, W. P. Taylor, who has charge of the bureau of investigations and housing requirements and of the special appointed committees on site determination. Mr. Taylor is concerned with the preliminary decisions on prospective housing developments. The other assistant, Robert Jemison, Jr., is in charge of the production bureau and the property bureau which take care of the actual housing operations.

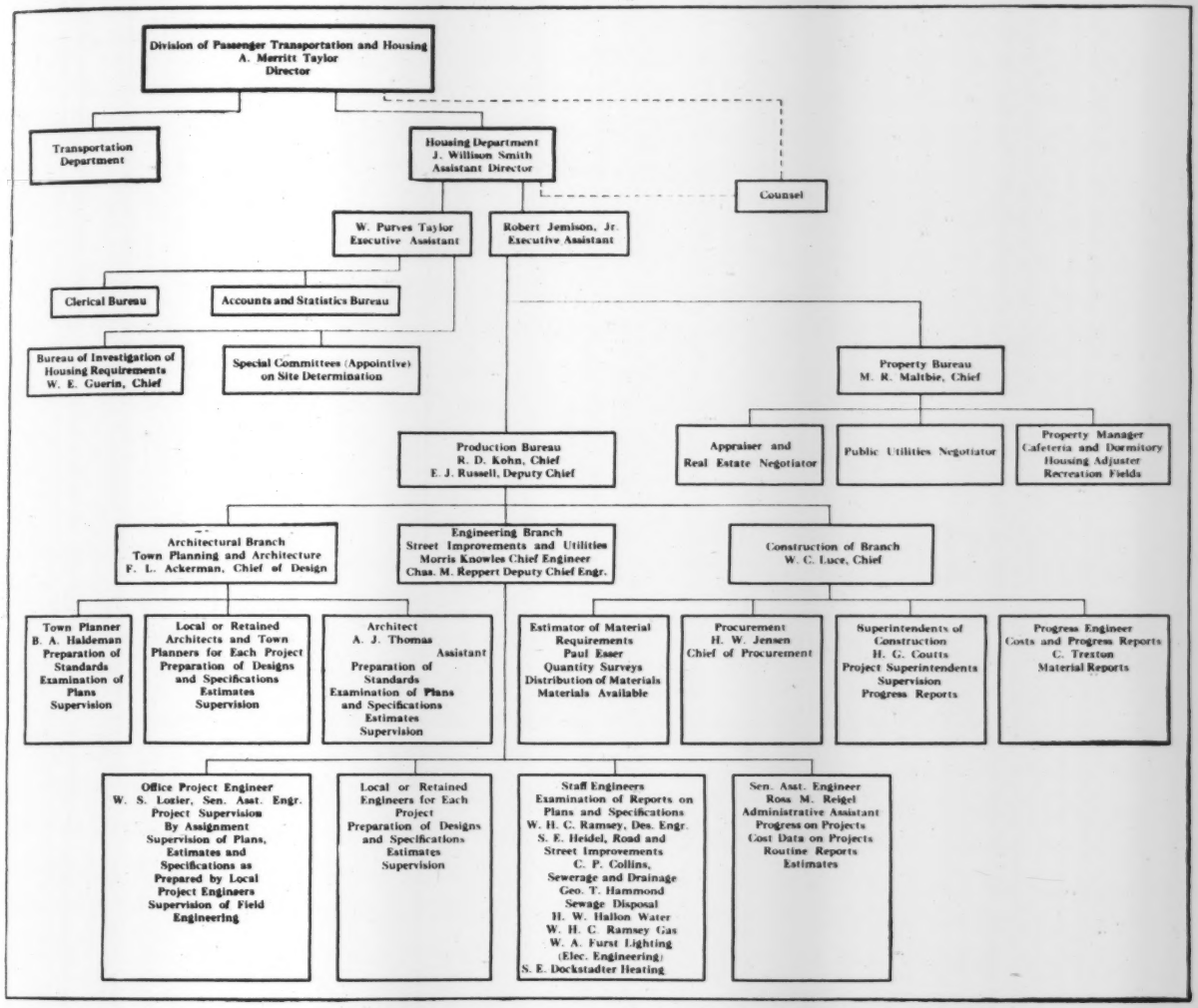
The production bureau, with R. D. Kohn, architect, of New York, as chief, has three branches, architectural, engineering and construction. The property bureau, under Milo R. Maltbie, experienced in the supervision of New York public utilities, has charge of the real estate appraisal and negotiations, the public utilities negotiations and the management of the property for which the Government has assumed responsibility. Architecture and town planning are under the direction of F. L. Ackerman, architect, of New York; engineering developments are under Morris Knowles, consulting engineer, Pittsburgh, with Charles M. Reppert, of the Pittsburgh sewer department, as deputy chief engineer, and the construction branch is in charge of W. C. Luce.

In operation the system works as follows: A shipyard needs housing accommodations. It applies for Government assistance. The application is first referred to the Bureau of Investigation. The preliminary investigation is made by representatives of the housing department and of the transportation department. If it is found that additional passenger facilities will not solve the difficulty and that houses are required, reports are submitted by the architectural, the town planning and the engineering branches of the division of production, and by the site selection committee. This preliminary investigation is made for the purpose of selecting the site, of determining its suitability and adaptability and probable cost of development. Availability and financing of the utilities are other local factors which must be considered. Transportation may be the solution of the difficulty, and then the transportation half of the division takes over the problem. If it is decided that new houses are necessary the main administration first decides upon the amount to be spent and the nature of the development. The production bureau then takes care of the matter and builds the houses and develops the property.

Preliminary Reports Made

The preliminary reports are made in conformity with instructions issued by the department. Blank questionnaires which are very elaborate are furnished, and when they are filled out they answer all of the necessary questions about which the production bureau must be informed.

When the department has decided upon the nature of a development and has appropriated the necessary funds, a local project board is appointed. This consists of an architect, a town planner and an engineer appointed by the housing division upon the recommendations of the heads of the various branches. This



ARCHITECTS, ENGINEERS AND BUILDERS REPORT THROUGH PRODUCTION BUREAU

local project board has responsible charge of the designing and preparation of plans, estimates and specifications for the entire project. It is organized with a chairman (generally the architect), who is appointed by the director. The board proceeds to make the necessary investigations, studies, plans and estimates and submit them for examination and approval of the production bureau. Each member of the local project board has to prepare the designs for his field; that is, the town planner has to make up the street layout plan, and consider the general locations of buildings and structures, landscape work, etc., the engineer has to provide the designs for the street improvements and utilities, and the architect the design of the houses themselves.

The local project board consults and advises with the representatives of the production bureau in conference and by correspondence about the development of the plans and keeps in touch with that department as to progress. It follows, moreover, a set of instructions and recommendations for designing in so far as the restrictions of the local problems permit. These general instructions are prepared in the home office and are not designed to fix arbitrary standards except in certain matters where standard practice is well understood and accepted, but they are intended to assist the local board and to reduce the general construction problem by the standardization of details. The local project board also furnishes estimates of quantities and materials required.

Meanwhile, the property bureau is at work on the real estate purchase and negotiations, and is studying the public utility relations. It is concerned mostly with the legal end of the public utilities question and depends upon the engineering branch for the technical details and for advice.

There is then appointed in the headquarters office a project manager for the job in each of the architectural and engineering branches. These managers may each have charge of more than one job. They are the headquarters' representatives responsible for the work.

The design having been prepared and approved at headquarters, the contract for the construction is let and the construction turned over to the construction branch, which carries out the work under a local superintendent. This local superintendent has under him the local project engineer and architect and town

planner, although these men also report back to their respective offices at headquarters. The construction branch also has sections on estimating and on procurement.

The engineering branch has an organization peculiar to itself. Under Mr. Knowles and Mr. Reppert is a staff of engineers, each of whom is a specialist in his particular line—that is, in road and street improvement, sewerage and drainage, sewage disposal, water, gas, electricity and heating. These engineers act as consultants with the office project engineers who have charge of one or more local developments. The project engineer, as has been stated before, supervises the plans, estimates and specifications as prepared by the local engineers but calls in to aid him as consultants in the supervision any or all of the staff engineers. The office engineers also, of course, have supervision of the standards in their own fields of engineering.

Engineering constitutes a large part of the preliminary design of a housing development. Highway systems, including sidewalks and pavements, drainage, water-supply, sewerage, sewage disposal, gas service, electric service and street and house lighting, are under the direction of the engineer. The house itself is taken care of by the architect, and the engineer does not enter into its design or construction except when requested.

The projects which have been approved, together with their approximate size, and the personnel of the project boards and contractors, are given in the accompanying table. Of these projects those at Bristol, Camden, Newport News, Hog Island, Philadelphia, Portsmouth, Chester and Wilmington are well under construction.

The method of financing the projects is briefly as follows: The Emergency Fleet Corporation lends money to a realty company formed by a shipyard particularly for that purpose and advances the full cost of house construction at a rate of 5% interest for a period not exceeding ten years. The shipbuilding company furnishes the land free of cost and in many instances contributes to the cost of utilities and the Emergency Fleet Corporation is given a first mortgage on the development as security. Provision is made for appraisal not earlier than two years and not later than five years after the conclusion of the war, at the option of the Emergency Fleet Corporation. As the result of this appraisal there may be a maximum write-off on the mortgage of 30% in recognition of excessively high construction cost.

The Emergency Fleet Corporation holds not only a first mortgage as security for its advances but the stock of the realty company is assigned to it as further security. The Emergency Fleet Corporation also controls the sales and renting and restrictions on property for six months after the conclusion of the war and has full charge of the design and construction.

HOUSING PROJECTS APPROVED BY THE EMERGENCY FLEET CORPORATION, DIVISION OF PASSENGER TRANSPORTATION AND HOUSING

Shipyards	Location	Character Proposed Housing (Approx.)	Men to Be Housed (Approx.)	Estimated Cost	Project Architect	Project Engineer	Contractor
Atlantic Corp.	Portsmouth, N. H.	300 houses, dormitories	1,000	$1,400,000	Kilham & Hopkins, Boston	Lockwood, Greene & Co., Boston	National Engrg. Corp.
Newport News S. B.	Newport News, Va.	498 houses, 320 apts.	1,636	3,000,000	F. Y. Joannes, N. Y.	G. F. Faney, F. Bulot	Mellon-Stewart Co., Pittsburgh. James Stewart & Co., N. Y.
New York S.B. Co.	Camden, N. J.	200 row houses, 907 single and 1614 group hos. schools, stores, comm. bd. or 1000 single, 2,000 group houses and stores	400	7,800,000	E. D. Litchfield, N. Y.	Lockwood, Green & Co., Boston	Tidewater Bldg. Co., N. Y.
Pusey & Jones	Gloucester, N. J.		1,400	2,470,000	Bissel & Sinkler	Day & Zimmerman, Phila.	McArthur Bros., N. Y.
Bethlehem S.B. Co. Pusey & Jones.	Wilmington, Del.	506 houses	1,012	2,500,000	Ballinger & Perrot, Phila.	Ballinger & Perrot	McArthur Bros., N. Y.
Bethlehem S. B. Co.	Sparrows Pt. Plant	302 conv. apts., kitchens and mess halls; 531 houses	2,868	4,300,000	E. L. Palmer, Baltimore	G. W. Stevens, Baltimore	Consolidated Engrg. Co., Baltimore
Chester S. B. Co.	Chester, Pa.	277 houses, 108 apt. and boarding houses, dorm.	1,933	2,350,000	G. E. Brumbaugh, Chester	C. F. Mebus	McArthur Bros., N. Y.
Texas S. B. Co.	Bath, Maine	150 houses, dormitories	600	750,000	R. Clipston Sturgis, Boston	Aspinwall & Lincoln	
Merchant S. B. Corp.	Bristol, Pa.	42 bunk houses, 14 bdg. houses, 161 apts., 75 single and 135 group.	3,816	4,350,000	Carrol H. Pratt, N. Y.	Emerg. Fleet Corporation	Fred T. Ley & Co.
American Int. S. B. Corp.	Philadelphia, Pa. (Hog Island)	960 houses, 16 dorm., ath field, 300 houses (requisitioned)	4,692	7,031,000	E. M. Bartlett, Phila.	Owen Brainard, N. Y.	William Crawford, Phila. Moss & Taylor, Phila. H. D. Schneider, Phila.
Sun S. B. Co.	Chester, Pa.	622 houses	1,000	2,250,000	Ernest Flagg, N. Y.	A. F. Demon	Johnson & Price
G. M. Standifer Cons. Co.	Vancouver, Wash.	100 houses, hotel	1,000	350,000			
Bayles S. B. Co.	Port Jefferson, N. Y.	Dorms. and frame houses	400	200,000	Alfred C. Bossom, N. Y.	Holbrook & Higgins	
American S. B. Co.	Lorain, Ohio	200 frame houses	400	720,000	Abram Garfield, Cleveland	R. Winthrop Pratt	
Merril Stevens S. B. Co.	Jacksonville, Florida	150 houses and dorm.	200	350,000	H. J. Klutho, Jacksonville		
Westinghouse E. & M.	Essington, Pa.	200 houses and dorm.	420	800,000			
			300	250,000			
Terry S. B. Co.	Savannah, Ga.		400	750,000			
Traylor S. B. Co.	Cornwells, Pa.	Tents	300	5,000			

Would Rate State Highway Contractors on Past Performance

Propose Giving Contractor Part of Saving Under Estimated Cost and Advantage in Bidding Proportionate to Speed and Efficiency Shown

By S. E. Fitch
New York State Highway Department, Hornell, N. Y.

OFFERING the contractor an incentive to do better work both by giving him a percentage of the savings under any estimated cost which he may effect in carrying out the work, and by taking his record for efficiency into account through a rating system which reduces his bids in proportion to his speed on former contracts as compared with the estimated time of completion, is the chief proposal in a new system of carrying out highway work under contract which is here put forward both as an answer to the difficulties created by war conditions in carrying on highway work and as making for better and cheaper road construction in normal times.

To those who have been acquainted with the highway situation for the past few years it is very evident that the present method of letting state road contracts to the lowest bidder who can furnish bonds has serious fundamental defects. It is to be hoped that some of them will be removed while our country is passing through war's crucible in which the pure metal of civilization is being separated from the dross of false ideals.

To understand these defects better and to start with our wheels of thought out of the ruts along which they are prone to follow, let us inquire into the fundamentals of road contracting.

Characteristics of a Good Contractor

First, the contractor whom we want to build our road is the one who can do it better, more cheaply and more quickly than any other man. Second, he who is capable of doing this is entitled to a profit larger than that of the other contractor in direct proportion to his ability to save time and reduce costs. Third, in these days of scarce labor, he will do his best, cheapest and quickest work only when he has built up a good organization and has the proper equipment within reach. Fourth, such an organization can be built up and maintained only when the contractor has a reasonable prospect of keeping it busy year after year. Fifth, in order to get the best work out of any contractor or organization—to "keep it on its toes"—there must be competition, and there must be constantly in view an adequate incentive for extra effort. The best incentives seem to be furnished by placing a real value on reputation and allowing extra profits on whatever savings the contractor can make. Sixth, the less the risk of loss which a contractor must take the less the profit with which he will be satisfied. Seventh, it is everywhere recognized that the best results can be obtained only when contractors, engineers and all concerned work in harmony. Lastly, the amount of time taken to complete a road is very important and has an actual cash value which can be approximately computed. This should be taken into account in selecting the contractor and, directly or indirectly, in rewarding him.

Probably most men, whether familiar with road work or not, will concede the truth of these fundamental principles. To be logical we should take up each in turn and see how the present form of road contract meets the requirements. This seems hardly necessary, for the many articles appearing from time to time in the engineering and contracting journals show that practically none of the above requirements is at present being satisfied, a statement which I think all road men will accept without requiring detailed proof. The causes which have brought about this condition will be briefly reviewed.

State Road Work a Recent Development

A few years ago state road work as it is known today was new. Very few contractors knew the business well or had the necessary equipment and organization for doing the work. There was but little competition. Preliminary estimates were high and contracts were let at good prices. Specifications were not rigid nor so closely observed as today. Contractors consequently made large profits. The news spread rapidly. Engineers, foremen, farmers, merchants, editors and politicians became contractors overnight. They guessed the percentage that they could cut the engineer's estimate and secure the work. To the lowest guesser was awarded the contract, regardless of his reputation or ability, provided he could furnish bond. The bonding companies were out gunning for contractors and would furnish bonds to anyone who had a wheelbarrow for equipment and often to some who had not. Frequently, types of roads were selected which were not suitable for the location, some were poorly designed, and many more were not properly built. There was some dishonesty and plenty of politics mixed up with it all. Much money was wasted and many poor roads resulted. Then came the reaction. Specifications were revised and tightened up from time to time and their enforcement insisted upon to the letter. Additional laws were passed and various interpretations of the law, some of them absurd, were handed down. Invariably these things were in favor of the state and against the interests of the contractor. Low bidding forced the more able contractor out of the road business. Low bidding and poor management sent the less able one into bankruptcy. Successive crops of would-be contractors sprang up and trod the same rocky path until about two years ago, when the pendulum began to swing to the other side. Then war sent prices of labor and materials soaring, until today contractors are afraid to bid on work at all, and when one does occasionally obtain a contract, he finds it extremely hard if not impossible to induce bonding companies to furnish bonds. This is the situation today and is the reason why we find the various forms of cost-plus contracts being advocated and tried out.

It was the writer's good fortune to be in charge of the cost-plus-percentage road contract at the Camp

Custer cantonment, Battle Creek, Mich., and to have the opportunity to contrast the working of that form of contract on road work with the ordinary itemized, lump-sum contract which he has had under observation during the past eight years. The contrast is great and in most things in favor of the cost-plus contract. He feels very strongly, however, that somewhere between the two forms lies the real solution of the problem. He has no criticism for the cost-plus form of contract for such work as cantonment construction, where speed, and not cost, is the first consideration. But for state road work the cost-plus contract would be fundamentally weak in two particulars. First, in the cost-plus contract the contractor is merely selected by the officials in charge without reference to anything but his reputation and ability. History shows that the heads of highway departments have not always been selected from honest, capable men. To give a dishonest or weak head of department an opportunity to use such power would prove disastrous. Second, any condition under which a contractor's profits do not depend directly on his efforts is fundamentally wrong. No matter how honest or conscientious the contractor himself may be, this knowledge penetrates throughout the organization, and until human nature is changed it is bound to detract greatly from its efficiency.

Present Time Opportune to Make Changes

It is perfectly feasible, however, on state road contracts to retain all the advantages of the cost-plus contract and to eliminate the disadvantages mentioned. Also, the benefits of healthy competition may be retained and the advantages of increased speed and efficiency obtained by allowing the contractor to share financially in such savings of time and money as he may be able to effect through his efforts and ability. To do this will require some changes in the present laws, but this is a time when changes of many kinds are being made in all lines of human endeavor. If the advantages of a change can be made clearly apparent, it may be effected more easily now than ever before.

The form of contract contemplated is one in which the detailed plans and estimate would be prepared in the usual manner. A contractor would be asked to bid on each item an amount sufficient to cover his profit for the use of his organization only. This would correspond closely to bidding on the percentage in a cost-plus contract. The state would maintain a field auditor and have a complete system of time-keeping and material checking, and would pay for all labor and materials. The contract would provide a schedule of rental prices for such plant as was owned by the contractor and also for paying an approved rental price for such other plant as was considered necessary. Extra work, not itemized, would be limited to such as had been authorized in writing, and the cost of which could be kept separate from that of other work. The bids on extra work and on overhead costs would be on a percentage basis, and the percentage either specified for all bidders in the proposal, or else given narrow limitations, to do away with any tendency to pad the overhead and extra work at the expense of other items.

The fundamental idea in mind is to establish a "standard cost" for the work, and a "standard time" for its completion with which the actual cost and the actual time taken for completion by the contractor can be compared; then to pay the contractor a definite extra compensation in case the actual cost was less than the "standard cost" and pay a proportionally less compensation if it were more. In a similar manner those contractors showing the best speed as compared with the "standard time" on all work that they had previously completed would be allowed a definite scheduled advantage over other bidders on subsequent bids on similar work. This, very shortly, would automatically eliminate those slow, puttering contractors who have so many times obtained contracts and dragged their work along over several years. There are, of course, difficulties in reducing such a plan to a mathematical basis, but it need not be absolutely exact to be far ahead of the present system. It must, however, convince all men that it is 100 per cent. honest, even though it be but approximately accurate. It is plain that, provided the specified time for completion of a contract is reasonable in the first place, practically any job can be completed within that time by increasing forces, working overtime, etc. It may make the work more expensive to rush it through, but it involves no hardship on the contractor as long as he knows the exact condition when he is bidding.

Since the exact quantities of the various items and of extra work cannot be known until the job is completed and measured up, it will be necessary to revise the "standard cost" on completing the work by using the actual quantities, multiplied by the unit-cost prices used in the preliminary estimate. In a similar manner the revised "standard time" of completion would be found by multiplying the specified time by the ratio of the revised "standard cost" to the "standard cost" as used in the preliminary estimate. This would prevent injustice being done by reason of changes in the amount of work.

Basis of Settlement with Contractor

The contract should be so drawn up that settlement with the contractor will be made by multiplying the actual quantities of each item of work done by the bid price on each item. The sum of these results will give the fee to which he will be entitled in case the actual cost of the work is exactly the same as the amount of the revised preliminary estimate. Call this his "normal fee." The actual cost would, of course, differ from the "standard cost" somewhat. The contractor's actual fee then would be obtained by adding algebraically to the "normal fee," obtained as above, a definite, stated percentage (say 20%) of the difference, increasing the fee if the cost were less than the standard cost and decreasing it if it were more. It probably would be possible to modify this fee further in some manner by allowing another increase in it for completion before the standard time and a corresponding deduction for using more than the standard time. This would be more difficult, however, and would not prevent a slow contractor from obtaining a contract and dragging it along as before.

It is believed that the same result can be better accomplished by grading all contractors doing state road work by giving them a "speed factor." These speed factors would be calculated each winter and a list of such contractors with their speed factors published, or

held open to public inspection, before any lettings of the season. Each succeeding winter they would be recalculated, including the contracts of the season just passed. Thus each succeeding year would make possible a more and more definite index of each contractor's ability so far as speed is concerned. These speed factors would be obtained by dividing the number of days used on the construction by the number of days, as revised, allowed in the contract. Thus, if a contractor had a speed factor of say 90 it would really signify that on all contracts which he had completed prior to the computation of his speed factor he had used but 90% of the time allowed him by the terms of the contract.

In order that the contractors having good speed factors may reap the benefits of their speedy work, and also for the purpose of preventing the award of contracts to the slowest ones, thereby depriving the public of the use of the roads during a long construction period, it is proposed, for the purpose of award only, to modify each contractor's bid by multiplying it by his speed factor. The products thus obtained would be compared instead of the bids themselves, and to the contractor whose result was lowest would be awarded the contract at his bid prices. In this way the contractor would receive a substantial reward for the benefits arising from his fast work, and the state would get its road enough sooner to do more than pay for the difference in cost.

It might be thought that this would place too high a value on the time saved and that the state would be paying the contractor more than the time saved would be worth. If such should prove to be the case it would be an easy matter to calculate the speed factor by adding to or subtracting from 100 a half, a third or some other fraction of the percentage of time saved, thus retaining the principle of the idea but modifying the value allowed for time-saving.

Consider that the time specified for doing a quantity of work which was estimated to cost $143,000, as shown in the table, was 120 days, but more work was done than was estimated. Its total amounted to $145,700 when calculated on the basis of the same estimated unit costs. Therefore the revised standard time allowable would be 120 × 145,700 ÷ 143,000, or 122 days. Assuming that this is the only contract that this contractor has completed under this system his speed factor would be the time he used on construction (say 110 days) divided by the allowable time of 122 days, or 90.2.

The following year a similar proposal is advertised, and this contractor, who will be called A, has his time factor of 90.2. In a similar manner Contractor B, having used slightly more than the allowed time, obtained a speed factor of 105. Contractor C, who wishes to bid, has done no previous work for the state, therefore his speed factor will be taken as 100. The short table shows each contractor's bid, his speed factor, and his comparative rating on this proposal.

CONTRACTOR'S RATING AS DETERMINED BY SPEED FACTOR

Contractor's Name	Contractor's Bid	Contractor's Speed Factor	Contractor's Comparative Rating
A	$12,350.00	90.2	11,139.7
B	10,761.90	105.0	11,300.0
C	11,400.00	100.0	11,400.0

PROPOSAL

Preliminary Estimate

Estimated Quantity	Item	Estimated Unit Cost	Amount	Contractor's Bid Item Price	Amount
60,000 cu.yd.	Earth excavation	$0.70	$42,000.00	$0.06	$3,600.00
12,000 cu.yd.	1st class concrete pavement	8.00	96,000.00	0.70	8,400.00
Lump sum	Extra work		2,000.00	7%	140.00
Lump sum	Overhead		3,000.00	7%	210.00
Total estimated cost			$143,000.00	Total bid,	$12,350.00

Time of completion specified as 120 calendar days.

Final Estimate

Preliminary Estimate Revised by Using Actual Quantities of Work Done

Final Measured Quantities	Item	Estimated Unit Cost	Amount	Contractor's Profit Item Price	Amount
62,000 cu.yd.	Earth excavation	$0.70	$43,400.00	$0.06	$3,720.00
12,100 cu.yd.	1st class concrete pavement	8.00	96,800.00	0.70	8,470.00
As in preliminary Estimate	Overhead		3,000.00	7%	245.00
Actual Cost	Extra work		2,500.00	7%	175.00
Total of revised preliminary			$145,700.00	Total	$12,610.00
	Add 20% of saving made (see below)				1,140.00
				Total Contractor's Fee,	$13,750.00
Total of revised preliminary estimate, or "Standard Cost"					$145,700.00
Total actual cost of work as shown on auditor's books					140,000.00
Saving made over revised preliminary					$5,700.00

In this case Contractor A has the lowest comparative rating and the contract will be awarded to him although his bid, which will be the basis of final settlement, is higher than either of the other two. This is but justice, for he has proved by his previous record that he will complete the work sooner than his rivals, even if he has to sacrifice some profit to do so. The time saved is worth more to the public than the extra cost due to the speed factor, and the prime purpose of getting the road completed and opened has been accomplished.

The annual cost of a mile of improved road is the sum of interest on first cost, annual ordinary maintenance cost, and an annuity sufficient to pay the cost of reconstruction when it becomes necessary. This annual cost will average about $1500 per mile per year. The annual cost may safely be taken as the minimum value per year, otherwise it would be a mistake to build the road at all. The annual report of the Highway Commission of the State of New York shows that of 164 county highways accepted during the years 1916 and 1917 the average length was about 3½ miles and the average time elapsing from the award of contract to its acceptance was about 18 months, or about 5 months per mile of road. The minimum value to the public of this 3½ miles is $1500 × 3½, or $5250 per year. Plainly, then, the state could afford to pay the contractor a considerable percentage of this $5250 if by so doing it could shorten the construction period by a year.

After this scheme had been in operation for a few years, the undesirable contractors would be automatically eliminated, the improvements in the details of the contract would work themselves out, and experience would enable the engineers to specify very closely the most economical time for completion. Contractors would then bid with the idea firmly fixed in mind of completing the work in the time specified even at a somewhat increased cost with a consequent decrease of profit. The speed factor and the sliding scale of profit would act as an automatic governor to maintain the proper relation between the time of construction and the cost of the work.

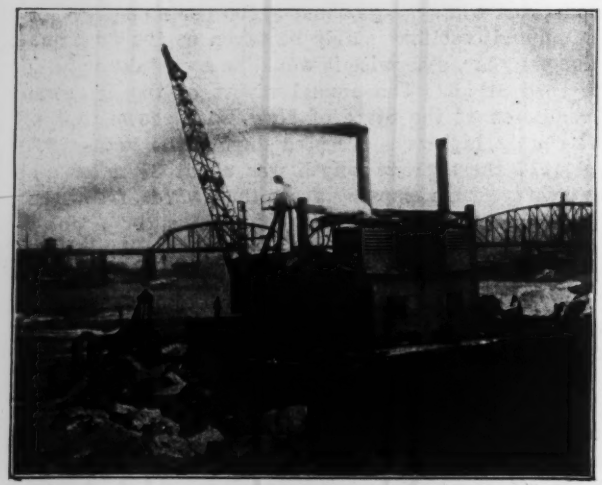
Stone-Filled Sunken Barges Form Basis of Temporary Dam

High River Level for Pittsburgh Water-Supply Intake Was Maintained After Government Dam Went Out

SEVEN 90-ft. wooden barges were filled with stone and sunk in the Allegheny River during May to form the core of a temporary dam across the 350-ft. break in Government Dam No. 2, just above Pittsburgh, which was wrecked when the ice went out of the Allegheny River this spring. Rapidly completed by placing a mound of stone across the river, the work prevented a possible interference with the operation of Pittsburgh's water-supply system.

The break in the dam, which is one of the Federal Government's improvements on the Allegheny, did not seriously interfere with traffic on the river, but it did lower the water level to such an extent that the operation of the pumping station in the City of Pittsburgh's water-supply system was interfered with. This station is located one mile above the dam and supplies raw water to the filter plant. The curtailment of its supply of water would have resulted disastrously to the city. Owing to the great variation in the water level between high and low water, the pumps in the station had to be so placed that in ordinary low stage of the river there is a suction lift of about 23 ft. The break in the dam would have required a suction lift of 29 to 31 ft. during the summer months when water was most needed.

Plans were first made to install low-lift pumps on the river bank to pump water during low stages through the tunnel to the suction lines of the main centrifugal, and a water siphon system in the suction line of the

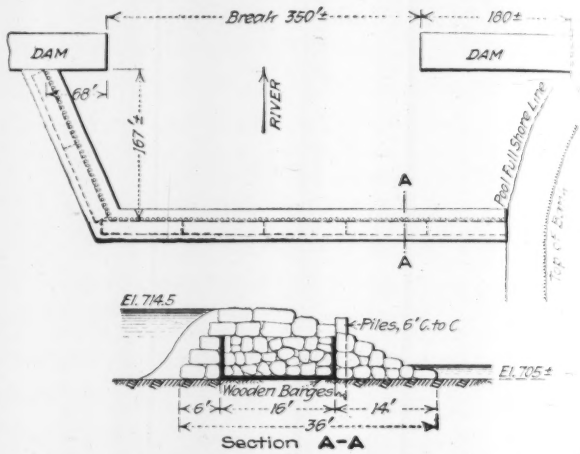


DERRICK MOUNTED ON BARGE PLACED LARGE STONE ON TEMPORARY DAM ACROSS THE ALLEGHENY

100,000,000-gal. pump was also considered. These were all rejected, and it was decided to make temporary repairs to the dam by building another dam on the upstream side of the break, holding the water level at a point that will permit continuous normal operation of the pumping station.

At this location the river bed is mostly sand, which made it impracticable simply to dump rock into the water, as the current would soon have washed the sand away and undermined the temporary mound. The sunken barge method was then adopted.

A line of wooden piles was first driven on 6-ft. centers across the opening of the break on a broken line, as shown in the accompanying drawing. On the upstream side of these piles seven regular wooden river barges loaded with stone were sunk, two along the wing ex-



DAM REPAIRED BY THROWING TEMPORARY STONE MOUND ACROSS RIVER ABOVE BREAKS

tending out from the center section of the dam and five along the straight section which is parallel to the main dam. Upon these sunken barges as a mattress stone of large size was piled to form the main mound.

The laying of this stone was accompanied with considerable difficulty, on account of the strong current in the river. The stone was unloaded from freight cars to barges which were towed out alongside of the sunken barges, and was deposited as shown in the photograph by a derrick boat carrying a Dravo "whirler" equipped with an 81-ft. steel boom. In spite of the fact that the river current prevented the machine working at its full capacity, an average of 550 tons of stone a day was placed with the equipment.

Work continued from Mar. 21 until May 4. In spite of some difficulties in connection with the shipment of the stone, which was obtained from a point west of Cleveland, the 8500 tons of stone was all placed by the later date, and the possibility of low-water troubles at the pumping station was eliminated. The total cost of completing the work was about $55,000. Time was the essence of the contract. The work was done for the City of Pittsburgh by the Dravo Contracting Co., Pittsburgh.

Illinois Waterway is Authorized

Barge traffic between Chicago and the Mississippi will be made practicable by the improvement of the old Illinois & Michigan Canal, which improvement has been authorized by the United States Government. For this new waterway link, extending from the Chicago Drainage Canal at Lockport to a connection with the Illinois River at La Salle, the channel will be dredged and cleared to give a 6-ft. depth.

Cast-Steel Anchor Chain Developed To Meet War Need

Electric-Furnace Steel Product Stronger Than Iron Chain Though Less Ductile—Drop Tests and Proof Tests Made

How successfully American industry adapts itself to urgent but radically new demands of the war administration finds striking illustration in the development of a new kind of anchor chain last winter. This development was sketched in a remarkable paper read by H. Jasper Cox before the American Society for Testing Materials at its recent meeting. Two prepared discussions of the paper added much information on the course of the development and the qualities of the product. Short extracts from Mr. Cox's paper and discussions, the first by W. I. Merrill and the second by C. K. Brooks, are reproduced here.—Editor.

In August, 1917, the shortage of anchor-chain production was brought to the attention of the ship-welding subcommittee of the general engineering committee of the Council of National Defense. W. L. Merrill of the General Electric Co., chairman of the ship-welding subcommittee, undertook a study of anchor chain production; while this work was going on, and under date of Sept. 13, the general purchasing officer of the Emergency Fleet Corporation addressed a letter to Prof. C. A. Adams, chairman of the general engineering committee above mentioned, noting the deficiency of anchor chain production and asking for recommendations as to the possibility of increasing this production by the employment of electric welding.

At that time Mr. Merrill had several proposals in hand, covering: (a) Straight electric welding; (b) drop forging of alternate links and electric welding of connecting links; (c) cast-steel chain. The last of these proved to be most promising and its development was rapidly pushed.

Tests of Short Lengths of Cast-Steel Chain

In October short lengths of cast-steel chain had been produced which, on being tested at the Charleston Navy Yard, showed a much greater tensile strength than that of wrought-iron chain, but with slightly less ductility. The uniformity and reliability of this chain was made possible by the employment of the electric furnace.

It was the general opinion that, in addition to tensile strength, toughness or resistance to shock was an extremely important feature of a satisfactory anchor chain. A series of shock and impact tests was then carried out by the General Electric Co. at Schenectady, N. Y., and later by the National Malleable Castings Co. at Sharon, Penn. As a result of these tests Lloyds' Register of Shipping determined to approve of the use of cast-steel anchor chain in merchant vessels.

Wrought-iron chain, either hand- or steam-hammer welded, has been used almost exclusively in ships to this day. Mild-steel chain has been tried, but has so far proved either too ductile to retain its form under stress or too hard to insure reliable welds.

In its first attempt to make cast-steel chain, the General Electric Co. used electric furnace steel, adopting the die-casting process with metal molds.

The links produced were perfectly sound and of good finish, but it was not found practicable to develop this process for commercial production, for the following reasons: (a) It was necessary to open the mold at a very critical time, while the metal was congealing; if left for a few seconds longer the links break, due to the core being solid; (b) if the mold was opened too quickly, the link being in a plastic state tended to deform.

They then made a considerable amount of chain, using sand molds and cores, experimented with heat treatment and photomicrographs, and eventually obtained links which pulled at from 60 to 100 per cent. above wrought-iron chain.

The general conclusions from tests were that the quenched link was somewhat superior to the annealed link and that the yield point of both was much in excess of that of wrought iron.

Experiments at Sharon, Penn.

At this time the subject was brought to the attention of the National Malleable Castings Co., of Cleveland, which immediately saw the resemblance between the problems of cast-steel anchor chain and car coupler knuckles. These knuckles not only transmit the entire tractive effort of the locomotive in pulling the train, but also receive shocks of great suddenness and intensity, both jerks and huffs, due to the surging of trains, the running out and in of "slack" during the application and release of brakes, and in coupling by impact.

After exhaustive tests and experiments some years ago this company had developed a special electric steel which combined with a high tensile strength a remarkable ability to withstand shock without distortion. This material they called "Naco" steel. They were invited to participate in the further development of cast-steel chain and prepared samples of 1¾-, 2-, 2¼- and 2⅝-in. chain, including both couplets of the common link of each size and the end combinations of special links and shackles. These samples were made of Naco steel and were tested on Mar. 1 and 2, 1918, at the Sharon plant.

Of the four different sizes of Naco chain tested statically the 1¾-in. chain showed an average breaking load about 73% above the specified breaking load of wrought chain, the 2-in. chain showed 86%, the 2¼-in. showed 75% and the 2⅝-in. showed 77%, or an average improvement of about 78 per cent.

In the dynamic tests, consisting of tensile shock tests applied through a Master Car Builders' drop testing machine to short sample pieces of chain, the 2-in. commercial wrought-iron chain in three tests averaged 142,680 ft.-lb., the Navy Yard wrought chain in two tests averaged 623,200 ft.-lb., and the Naco cast-steel chain in three tests averaged 1,902,400 ft.-lb., showing the *comparative* shock-absorbing capacity of the different chains. Using the figure 1 as the basis for commercial wrought-iron chain, the Navy Yard chain showed 4.3 times, and the Naco cast-steel chain 13.2 times as much capacity for resisting a jerk shock of this nature.

The general conclusion was that Naco cast-steel chain not only fulfilled all the requirements of a good anchor chain but was superior to welded wrought-iron chain.

The Emergency Fleet Corporation has ordered a considerable quantity for its new tonnage.

Work on the Chain Problem at Schenectady

The General Electric Co. assumed that wrought iron has been and still is a satisfactory material, and therefore set out to make a commercially practical composition of cast steel which, while it was easily cast into the necessary forms and sizes, would be soft and ductile. Softer or milder steels can be cast, but not quite so readily as the 0.30% carbon steel selected. The required degree of ductility in such a steel may readily be obtained by simple heat treatment. The result is a steel not especially high in strength, although far stronger than wrought iron (in fact, the yield point is equal to or slightly higher than the ultimate strength of wrought iron), but which has sufficient elongation and reduction of area to indicate a good degree of ductility. The average of the tests made on a great many heats would be about 35% reduction and 21% elongation. This metal, then, is not radically different from wrought iron in its tensile properties, and the approach to the physical characteristics of wrought iron is the more satisfactory when one considers that it is cast steel whose grain refinement is the result simply of heat treatment. Chain made from such steel would be stronger than wrought-iron chain; that is, under either a static load or impact, a higher stress would be required to deform it, while, when tested to destruction, it would be deformed nearly, if not quite, as greatly as wrought-iron chain when fracture finally occurred. The General Electric Co. felt it had offered a good answer to the problem set it, namely, a cast chain stronger than and equally as tough as the wrought chain universally used.

Warning Against Too Broad Conclusions

Ductile material will stretch before it fails and "short" material will break short. These are the inherent characteristics of the material. Therefore, the results showing, on the basis of the shock test, that with commercial wrought chain valued at 1, Navy Yard chain is 4, and cast-steel chain is 13, may be misleading if applied to the materials as such and used as an indication of their relative shock-resisting qualities." I wish in no way to give the impression that I do not believe that the Naco chain is not superior to any anchor chain ever produced, but wish simply to bring out the fact that too broad conclusions must not be drawn from the shock tests," said Mr. Merrill.

The usual way for engineers to make use of stronger material is to lighten sections, thereby increasing fiber stresses while keeping them in safe proportion to the elastic limit; but when the form and dimensions are fixed, the use of stronger material increases the safety of the structure. Weight per unit of length, and hence cross-section, of an anchor chain is fixed for a vessel of given proportions. Therefore, advantage may not be taken of the increased strength of cast steel to decrease the size of the links as compared with wrought-iron chain for a given vessel. Cast-steel chain must, therefore, be stronger than wrought-iron chain. In fact, it is probably the case that no impact stress great enough to cause failure of the Naco chain will ever occur in service; hence the shortness of Naco steel is not a disadvantage in anchor chain, while the stiffness of Naco chain is an enormous gain.

Car Coupler Experience Utilized

Several months ago, when The National Malleable Castings Co. was invited to participate in the experimental development of cast-steel chain, the first problem which required attention was the working out of suitable foundry methods for producing chain links in sand molds, and uniting them into continuous lengths of chain. A number of entirely successful equipments for making the molds was the result.

Connecting up the links into chain was accomplished in either of two ways: (1) The continuous process, in which the entire chain is poured from one heat, into previously prepared and united molds, by filling one interlinked mold impression after another; and (2) the precast link process, in which half the links comprising a complete length of chain are cast separately, shaken out, cleaned, inspected, and made ready for incorporation into the finished chain. Subsequently these links are placed in mold cavities and coupled up into continuous chain by pouring metal into other molds containing impressions for similar links, interlinked with the precast links.

Importance of Sound Castings

Another part of the foundry problem was the character of the mold. Recognizing the vital importance of sound castings in a product of this character, we came to the conclusion quite early in our experiments that all of the links should be produced in dry sand molds. The methods of application of gates and risers have also required some study, the details of which need hardly be set forth here. Suffice it to say that we have been able to secure very excellent results both in pouring through the stud and through the side of the link. In our preparations for manufacture, the adaptation of the method of heat treatment used for our car-coupler knuckles to 90-ft. shots of chain has involved some problems, but these have been solved and the process will be practically identical in method and results.

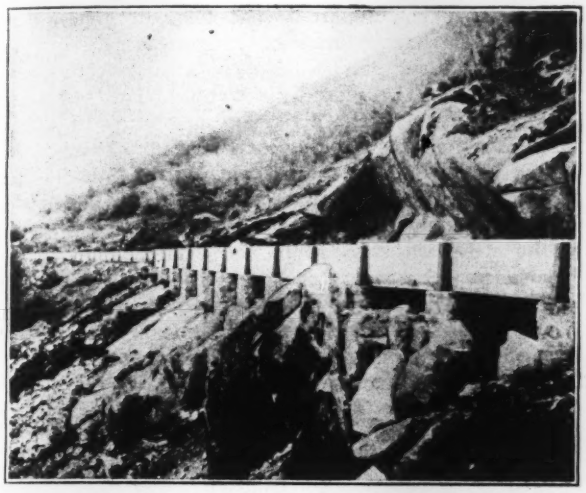
There are so many points of resemblance between the coupler-knuckle problem and that of cast-steel chain as we understand it, that we were able to start at a point which otherwise must have taken years of study and development, with the results set forth. In our opinion, a proper specification for cast-steel chain would require the making of links in dry sand molds or cores, but other details of manufacture should be left optional with the manufacturer. For the chemical requirements, the steel should be made by the electric-furnace process, with phosphorus and sulphur limits of not over 0.04%. The physical requirements should be sufficiently rigid to insure sound material, and should embody a dynamic test sufficiently severe to put the ability of the steel to withstand shock beyond any question of doubt. For this latter purpose we believe the standard M. C. B. drop testing machine presents the most readily available commercial machine, and a shock test on short pieces of test chain similar to the tests carried out at our Sharon plant seems to be as closely representative of the service to which anchor chain is subjected as any laboratory test can be.

Precast Concrete Slabs Make Durable Flume

After Five Years of Use Vertical Sides Are In Good Condition—Construction Found to Be Cheap and Simple

By S. L. Stovall
Stockton, Cal.

FIVE years ago the writer built a five-mile conduit on the Kaweah River in Tulare County, California, of which a large part had precast reinforced-concrete side slabs. At that time the use of this method was somewhat of an experiment, but the successful performance of the flume through these five years of service entitles it to consideration, particularly at the present time, when economy in labor and materials is called for.



PRECAST FLUME CARRIED IN PLACES ON BENTS

The conduit is 9 ft. wide and 4 ft. deep and about 25,000 ft. long; of this some 18,000 ft. has the precast sides, the remainder being a concrete lined ditch of trapezoidal section. About 3000 ft. of this cast section was on bents, as shown in one of the views, and the remaining 15,000 ft. was about equally divided between one-sided and two-sided flume resting directly on the ground, which was paved with concrete after the sides were placed.

Side slabs were made 12 ft. long, 3 in. thick at the top and 5 in. thick at the bottom. They had an L-shaped cross section. Wire fabric used as reinforcement was left projecting from the slabs as shown in the view, and later was carefully tied to the reinforcement as placed in the bottom of the conduit. All slabs were reinforced so as to form a cantilever with the bottom of the conduit, thus giving an ample factor of safety against overturning.

The yard for casting slabs was near the head works and covered nearly an acre There was abundance of rock and sand close by. The concrete was poured and left in the forms five days. The slabs were then edged up and left to cure two weeks. They were covered with burlap and kept wet two weeks from the time they were poured. When cured they were loaded into a car, two making a carload, and distributed along the conduit line over a narrow-gage railroad. Handling and moving slabs proved to be very easy and cheaper than handling an equal quantity of loose concrete material.

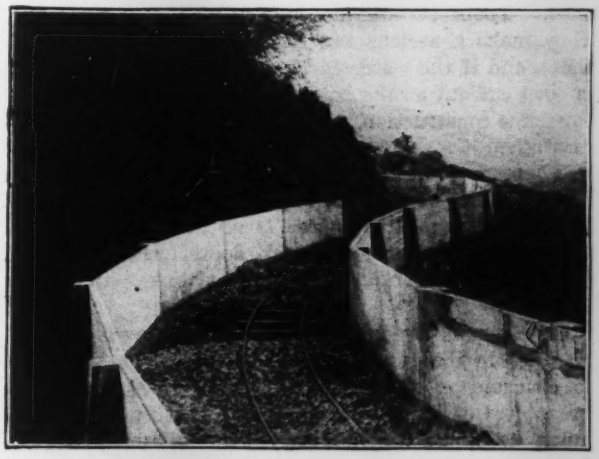
The forms used for the slabs were simple. A platform of the proper size was made by nailing 1½ x 8-in. boards, surfaced one side and tongued and grooved, to three 4 x 6-in. studs. These last were some 6 in. longer than the width of the platform. A collar was made that fitted around the platform and rested on the extended 4 x 6 in. studs. The four sticks making the collar were fastened together with hinges and hasps. It was a simple operation to sweep off the platform, brush with crude oil, and place the collar in position. It was necessary that the ends of the three 4 x 6-in. studs be solidly supported; otherwise there was settlement when the concrete was poured, and the resulting slab came out warped.

The forms lay flat and close to the ground. It required remarkably little work to dump the concrete into the form, get the reinforcement properly placed, and finish the slab.

A form for slabs cost complete $7.50. It was good for the making of 20 to 25 slabs.

All slabs were set 2 in. apart at the ends. A sheet-iron form was then hung over the joint on the outside and the pilasters were poured. The pilasters, in addition to closing the joint, added materially to the beauty of the structure and greatly reinforced the strength of the side slabs against overturning. After all slabs had been placed and sufficient rock and sand distributed, the railroad was taken up and the bottom of the conduit was plastered 4 in. thick with concrete.

The rock and sand for concreting the bottom of the conduit were distributed at the same time as the slabs and formed excellent material for use as ballast for the railroad.

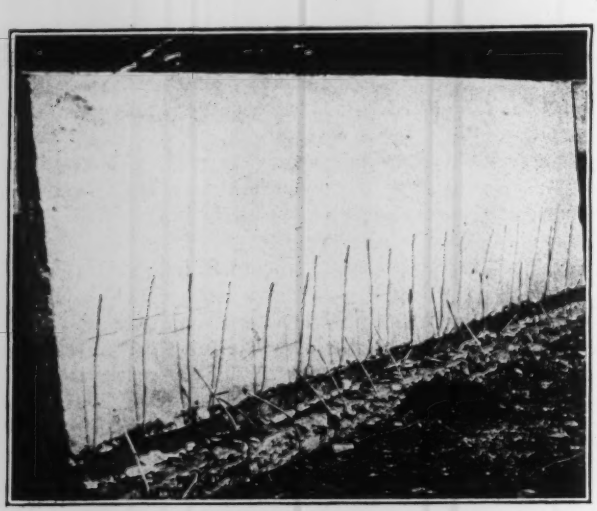


TWO-SIDED FLUME IN FOREGROUND. IN BACKGROUND THE FLUME IS ONE-SIDED

This conduit has been five years in operation. The writer went over it not long ago and gave it a careful examination. It was found to have stood up to expecta-

tions. What troubles have developed are small and such as always are incident to jobs first of their kind. Nothing has come up that cannot be easily handled on future installations. For instance, it is very essential that any gulch crossed be carried underneath the conduit in a culvert. This was not done in the case of some small gulches. During a long rainy spell water collected above the conduit in two of these gulches and made its way underneath. The conduit was undermined. This could not have happened if proper drainage had been provided.

The necessity at the present time for increased efficiency and conservation in the use of materials calls for radically new methods in the construction of flumes.



PRECAST FLUME SIDES HAVE REINFORCEMENT PROJECTING TO TIE TO BASE

There are serious objections to the use of timber and steel. Their installation and upkeep are expensive. They make a serious fire risk. The life of timber is short, and if the water carries much sand a steel flume is soon cut out at the bottom. Concrete, as a material for flume construction, meets all requirements most successfully.

Wherever flumes are to be built there usually is found an abundance of suitable rock and sand close at hand. With a concrete flume there is no fire risk, no decay, and practically no upkeep or depreciation. Such a flume, as a matter of fact, grows stronger and better with age.

Concrete flumes usually have been poured in place. Handled in that way, there are two serious objections to concrete as a material for flume construction. A great deal of lumber is required for forms—nearly as much as would be necessary for building a timber flume.

The deep narrow walls into which the concrete has to be poured make necessary the use of more material than the required strength demands, and the placing of this material in the restricted working space available is slow and expensive. Both of these objections are overcome in the precast flume. If, then, it is durable it is an admirable form of construction.

Season Cracking of Brass Discussed by Manufacturers and Laboratory Men

FACTS and opinions that add materially to our knowledge of cracking of brass and bronze—the so-called season-cracking—were presented before the American Society for Testing Materials two weeks ago in a symposium on season-cracking. The discussion told of two methods by which the season-cracking disease can be cured. It also indicated that much cracking trouble will be forestalled in future by using the mercury-solution test.

Opposing claims concerning the value of this test were made by W. Reuben Webster, of the Bridgeport Brass Co., and two representatives of the Bureau of Standards, P. D. Merica and R. W. Woodward. Mr. Webster, in a brief paper, reported that tests of good brass articles, taken from lines of manufacture known to show no failures in service, gave a large percentage of failures in the mercury-salt test. The test consists of immersing the article in a solution of either mercurous nitrate or mercuric chloride for a short time; the corrosive action of this solution on the brass brings about the formation of cracks at points where the initial stress in the superficial material from the cold working of the metal was very high, and where, according to experience, subsequent cracking in storage or service would develop—the so-called season cracking. Mr. Webster took such articles as lamp parts, finished parts of bicycle pumps, automobile hub caps and the like, as well as brass rods and sheet brass, none of which give any trouble in service ("complaints have very seldom, if ever, been reported"), and subjected them to the mercury test. Out of 36, 25 were injured while 11 showed no effects of the solution. For this reason he asserts that the test is too severe.

Messrs. Merica and Woodward, discussing the subject mainly from the standpoint of the amount of initial stress involved in the cracking phenomenon, said that many tests have shown that "a rod or tube which will crack in this test will also season crack, and conversely." On this account they described the test as being desirable and indeed necessary in the inspection of brass, but they asserted that for rods, tubes and the like which are to be subjected to tensile stress in service the test is not sufficient. "The authors can cite a number of instances," they said, "in which material, samples of which did not fail in the mercury salt solution test, did crack in service under the application of moderate service loads. The tensile stress at the surface of these articles was not alone sufficient to produce cracking, but when augmented by a moderate, externally applied stress, failure occurred." They therefore recommended measuring the initial stress at the surface, if possible, either by strain-gage measurements during successive removal of layers of the material, or by noting the amount of bend of a V-shaped longitudinal strip cut from the sample; as an alternative to this they suggested applying the mercury salt solution test while the specimen is stressed in tension.

How annealing reduces and eliminates initial stresses was investigated by the same observers. Using temperatures from 100 to 400° C., in all cases a temperature slightly over 200 resulted in practically complete removal

of the initial stresses. The times of annealing ranged from ½ to 7 hours.

The authors also investigated the effect of cold straightening samples of drawn rod. This procedure replaced the severe initial tension in the outer layers of the bars by compression, the stresses throughout the cross-section of the bar being redistributed at the same time. In view of the fact that annealing is "not readily adapted to present commercial practice and equipment," the authors say, such mechanical methods of relieving initial strain are the most promising.

Further practical facts on the value of annealing were given by W. B. Price, of the Scovill Manufacturing Co. The articles in question here were cartridge cases, which are severe cold work in manufacture and which in certain specific lots under test failed to pass the mercuric chloride immersion. Annealing for one, two and three hours at 500° F. was tried, and to measure the result of this treatment tensile tests were made, also microscopic examinations of the structure of the metal. The heat treatment did not produce any noticeable change in the physical properties of the brass. "Nevertheless, heat treating certainly diminished the degree of internal strain," he said. "Not one of the twelve cases which were tested from each of the four lots as heat treated failed in the mercuric-chloride test." The microscopic examinations also were satisfactory. The conclusion is "that a heat treatment of 500° F. for one hour does not effect a recrystallization even on the hardest portion of the shell, and yet is sufficient to relieve all internal strain and prevent the case from cracking in the mercuric-chloride test." A review of various factors influencing the occurrence of cracking in brass and bronze, given by W. H. Bassett, of the American Brass Co., included the results of an original study concerning the effect of cadmium on 70 = 30 brass.

Effects of Impurities and Admixtures

The evidence obtained did not show cadmium to increase the cracking tendency. The author also reported that lead, tin, iron and other common impurities or admixtures appear to have no distinct effect; antimony and bismuth also were cleared of responsibility for producing cracking. Fire-cracking, which occurs when a hard-drawn tube or rod is suddenly brought into a hot furnace, or when a spun or drawn shell is brought in contact with a polishing wheel, is held to be similar to season-cracking; but when thermal effects are not present corrosion is a necessary factor, and brass that is polished does not crack.

Henry S. Rawdon, of the Bureau of Standards, studied the mercury-solution test. The International Aircraft Standards Board specifies immersion in acidified mercurous nitrate; the Ordnance Bureau and the New York Board of Water Supply use mercuric chloride. He found that mercurous salts are considerably more active than mercuric, for the same concentration of mercury; that the size of the specimen need be given but little consideration; that polishing the surface of a specimen delays the cracking; that specimens should be examined for some time after removal from the solution; and that the cracks formed pass between the crystals of the metal (except when the action is quite violent), and are probably due to solution of the mercury in the alloy.

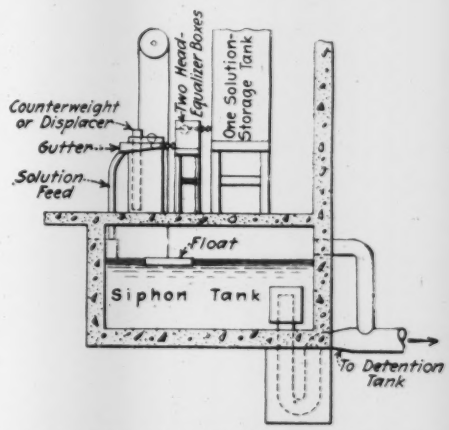
Siphon Operates Proportional Chemical Feeder

Displacer Automatically Proportions Feed of Chemical in Sewage Treatment Plant—Could Be Used for Water

By W. S. Lea
Consulting Engineer, Montreal, Canada

FOR automatically applying a chemical solution in proportion to the flow of the liquid to be treated, a design recently worked out for a sewage-disposal plant in Canada consists of float-operated displacers dropping into a constant-head solution box. Two siphon boxes are used, working alternately. The apparatus is also adaptable to water-treating plants.

In the plant described, the sewage will be passed through settling tanks, treated with a bleach solution and held in a detention tank before being discharged into a stream. As the necessary head is available



SIPHON OPERATES PROPORTIONAL CHEMICAL FEEDER

above the detention tank, it is proposed to provide two small tanks to receive the discharge from the sedimentation tanks, and install a siphon in each, with an individual discharge capacity somewhat in excess of the maximum sewage flow. The sewage will flow alternately into each siphon tank, being controlled by air-lock feeds. A fixed proportion of the total flow might have been utilized, passing it over a circular weir and intercepting the desired proportion.

The arrangement is illustrated diagrammatically, but the distributing channel, the air-lock feeds, the small compression and feed chambers, and the compression domes, starting bells and interconnecting piping recommended by the Pacific Flush-Tank Co. are not shown.

There is a float in each siphon tank, with a counterweight so hung that it sinks into or is withdrawn from a feed box as the float rises or falls. As a siphon tank fills, the float rises, and the counterweight sinking into the feed box displaces the solution, which is thus fed into the sewage in practically exact proportion to the rate of flow at any instant. After this siphon tank is filled, its siphon is vented and the counterweight is withdrawn as the tank empties, while the feed box fills up, ready for the next displacement. In the meantime the sewage is flowing into the other siphon tank and is

being treated with the solution displaced from the other feed box.

Strictly speaking, for exact proportionality of chemical feed to the flow to be treated it is essential that the tension be constant in the suspension line where it is attached to the float in the siphon tank; also that the supply to the feed boxes be shut off just at the overflow level, and that the necessary maximum head on their overflow weirs be infinitely small.

When the area of the float in the siphon tank is large in relation to the area of the displacer in the feed box, the effect of the variation of the tension in the suspension line is small. For example, with a float 20 in. in diameter and a 2-in. displacer, submerging 2 ft., the variation in the submergence of the float in the siphon tank due to this cause is only about ¼ in. Moreover, neglecting the friction of the pulley or shaft, the tension in the suspension line at the float will be constant, if the weight of the suspension line per unit length is equal to half the weight of the solution displaced per unit length of the counterweight. In fact, if it is considered worth while to do so, the effect of the change in the weight of the displacer as it submerges can be eliminated entirely, either by slightly increasing its area from bottom to top, or by a simple compensating device such as a heavy chain with free hanging ends; the chain being linked over a sprocket geared to the shaft which is turned by the movement of the float in the siphon tank.

With a constant-strength solution, the chemical dose can be varied either by using displacers of different areas, or by changing the amplitude of the vertical movement of the same displacer. This can be accomplished by attaching its suspension to different points on a cone pulley keyed to the shaft, which is rotated by the movement of the float in the siphon tank. The dose, in grains per gallon or pounds per million gallons, can be marked on the displacers in the former case and on the cone in the latter case.

This method of chemical feed can be used either with a tipping bucket or with a single siphon, instead of the two siphons, and although the proportional feed is not quite so effective, the compression domes, starting bells, etc., are not required.

Approve Development-Committee Plan of American Society

Prominent Engineers in This and Other Organizations Discuss Phases of Move, and Possibilities of Other Societies Co-operating

Prominent engineers have been asked by "Engineering News-Record" to comment on the resolution of the American Society of Civil Engineers creating a committee on development, as set forth in the issue of June 27, p. 1209. Members of the society were merely asked their opinions on the move. The views of members of other societies were also sought on the suggestion made by this journal that the other national societies form similar committees, all coöperating to lay out a broad program for the engineering profession. Replies are here published from Gano Dunn, Frederic P. Stearns and Fred Lavis, members of the society; and, of the second group, from Philip N. Moore, past president of the American Institute of Mining Engineers, and F. F. Sharpless, member of the institute and past secretary of the Mining and Metallurgical Society of America.—Editor.

Gano Dunn Sees Only Good in the Move—Thinks Other Societies Will Support It

Only good can come from the appointment of the committee on development by the board of direction of the American Society of Civil Engineers on June 18.

The rapid growth of the engineering profession, the tendency for it to consolidate, the eccentricity of its geographical distribution, the leaning toward including more than purely engineering matters among the functions of the national societies, and the augmented public appreciation of the essentialness of the engineer's services to the community, not only now in war but in the new conditions that will succeed it, all call for a fresh taking of the sun and increased gifts and vision in the piloting of the movement that is beginning to express itself. This expression may be observed in many significant happenings throughout the memberships of all kinds of engineering groups in the United States.

The more study professional development receives and the greater the number of points of view that are cultivated and respected, the surer shall we be in the end to mark a progress worthy of the ideals of our profession and of the intelligence that it represents. Failure to study will leave unheeded timely warnings and unseized opportunities that may not soon recur.

The American Society of Civil Engineers is to be congratulated on its opportune lead in this matter, which will probably be supported by other engineering societies both individually and through the Engineering Council.

Frederic P. Stearns Commends Move—Thinks November May Be Too Early for Report

The preamble and resolutions adopted by the board of direction of the American Society of Civil Engineers regarding a committee on development, and your editorial comments thereon as printed in *Engineering News-Record* of June 27, have been read with interest and approval.

There is need, under the changed conditions of the world, for the development of the scope of the work of the society, as set forth in the preamble, and the method of reaching the desired results by means of the committee provided for by the resolutions is to be commended.

In view of the importance of selecting suitable members for this committee, much time will be required by the 22 local associations of members of the society and by its president for selecting the full committee, and further time for selecting from this body the executive

committee. It is therefore not unlikely that Nov. 1, 1918, will be too early a date for an adequate preliminary report, but this does not affect the general merits of the project, as a well digested report presented several months later will meet all requirements.

It is especially important that the committee be carefully selected and that the executive committee be composed of men who will, as you suggest in your editorial, grasp the problem broadly and do much hard, painstaking work.

Fred Lavis Hopes Committee Will Help Us to Correlate Engineering with Business, and Think Internationally

The following very briefly expresses some thoughts I have in regard to the creation of the committee on development of the American Society of Civil Engineers:

The trouble with the American Society of Civil Engineers is that as a society it has been so obsessed with the technicalities of the profession that it has failed to realize the human side of engineering, and, more especially, the fact that engineering is an adjunct of business. With the present development of international business this would be a fatal defect if persisted in.

Even before the war America was developing a considerable interest in the affairs of the world. Our interests in Cuba and the Philippines gave many of our people their first realization that there are vital interests outside of the United States. The construction of the Panama Canal—a link in one of the great trade routes of the world—furthered this, and the present war is bound to make us think internationally and vitally realize many things which formerly we only dimly sensed through reading of them.

It is, therefore, of immense importance that the American Society of Civil Engineers has taken the step it has. Let us hope that the committee will work with a full realization of the spirit of the resolutions which created it and with a broad vision, not only of the function of the society to its members in the United States, but also in its relation to business and in relation to the future development of the United States as an important factor in worldwide work. To carry this out, of course, it will be most desirable that one or more members of the committee be engineers who have had a fairly wide experience outside of the United States, and while many of these are not available now on account of the war, it may be possible to find some who are not so engaged, or enlist the help of others, even though they may not be in the country at this time. Finally, let us hope that such well considered conclusions as the committee may present be not killed by internal politics, as so many previous attempts to get the society out of the rut it is in have been.

Philip N. Moore Thinks Societies Have Scarcely Touched Edge of Great Possible Field of Service

As I am not a member of the American Society of Civil Engineers, it would be improper for me to criticise its past policies or present plans for development, however much I may welcome any move in that direction on the part of so distinguished an organization.

My own views upon a not greatly differing problem in the affairs of the American Institute of Mining Engineers are on record in my address as outgoing president, delivered in February last. The quoted paragraphs in a way cover your question.

"Such a body as the institute has ever before it the two extremes of policy, either one of which, followed too far, leads to disaster. One is centralization with efficiency; the other, wide control with a large number sharing in its problems, mingling in its affairs, and thereby possibly leading to confusion, if not disharmony; and yet, both policies are needed.

"An effective body must have its centralized working board easily assembled, and able to speak with authority; at the same time, if its widely distributed membership, doing the real work of the profession in the mountains, mills and smelters, be not consulted actually, instead of nominally; if these men be not made to realize that they count, that their judgment is desired and has weight, inevitably loyalty lapses and yields place to indifference and criticism.

"The problem of wider or more democratic participation in the affairs of all national engineering societies is one of great difficulty, because, from the nature of things, the majority, especially of the men in their subaltern days, inevitably dwell in isolated communities, where opportunities for personal contacts with their equals, who think along the same lines, are rare. These are the men who are doing the real work of the profession. Those who dwell in the great cities have either passed subaltern days and reached the dignity of being no longer in the service of any one employer; or they are the chiefs of the great technical organizations needed at the nerve centers of the country for frequency of counsel and efficiency of control.

"The time removed from field contacts is apt to measure a certain loss of sympathy with the point of view of the field man. By such detachment he loses the insight of the younger man and tends to consider our common problems from the viewpoint of his neighbor. This is unconsciously done, and absolutely without intent to be inconsiderate. Its improvement constitutes one of the difficult problems of society administration; and yet, without its constant consideration in plan and action, the society loses the warm loyalty of the younger man which is its best asset for the future.

"In the local section the younger men have opportunity to meet their elders, to bring to preferment those whom they esteem, and through them, as representatives, to make an impression upon the consciousness of the main organization. Probably never before have your national officers so fully realized this situation, or so sincerely desired to give it cordial consideration. . . .

"The vision dwells in the minds of many that ultimately these four great societies [the four national societies], lightening the emphasis they place upon their differences, may see the time when, for the solidarity of the profession, for their best interests, as well as for increase of their influence on the country at large, they may become one great national association of engineers. With the gain in power and prestige inevitably following such an aggregation, freedom for individual development may be achieved through divisions along the lines of technical interests, which might either fol-

low the present four grand divisions, or be more minutely subdivided.

"An organization of this sort could and probably would be more strictly professional than any of the four have been heretofore, and through the prestige and power of its numbers could establish standards of ethical conduct for its members, violation of which would bring grave consequence."

In elaboration, further, I may say that I expect the time to come when the directors of the great national societies will be chosen by the local engineering societies dwelling in specified geographical districts. In order to respect the very evident necessity of having a quorum of the board resident contiguous to New York, it would be a simple and feasible matter to use the English system of choosing members of Parliament wherein any district can be represented by the man of its choice, no matter where resident. On this plan, it could be provided that each district, at certain intervals, would be called upon to select a man residing in or near New York as its representative. Such man would naturally be one known to and sympathetic with those naming him, and unlikely to be of a circle hitherto practically self-perpetuating. If to this he added the obligation to pay the traveling expenses of directors, to stated meetings of the board, there would necessarily come about a much wider participation in the decisions of each organization than is now possible.

I firmly believe that these societies have scarcely touched the edge of the great possible field of service to members and community.

If, in addition to this enforced widened system of control, there can be added some propaganda which will make the members realize that membership brings obligations as well as privileges, the possibilities of service will correspondingly increase. Certain it is that there exist wide unrest and dissatisfaction with the conduct of some of these societies in the past; equally certain it is that each step which has brought about wider participation in their affairs, even the result of a contest, has made for good.

F. F. Sharpless Doubts Only the Desirability of Identical Methods for All Societies to Effect Needed Changes

A nonmember of the American Society of Civil Engineers might give views that were quite unbiased but they might be quite as valueless, because of his lack of knowledge of its history and present condition.

One need not, however, be a member of this society to realize that the preamble to the resolutions points to a condition daily becoming more painfully evident to all engineers, namely, that this society and other engineering societies are not functioning so as to be of the greatest benefit to society in general; indeed, they are doing but a small part of that which is their privilege and should be their duty. Individuals within various major engineering societies have seen the light or have seen some light and have tried to guide our activities as societies into more useful channels, but the conservatism of technical organizations has been hard to overcome, and although a large number of our members have felt that there was a call to greater usefulness they have hesitated to assume any initiative.

Your suggestion that the action of the civil engineers be followed by similar action upon the part of the other engineering societies is in principle a most proper suggestion, but I question the advisability of all societies not equally conservative. Some constitutions permit of following identical procedure. All of our societies are broader action and greater usefulness than others; the membership of some societies is permeated with more liberalism than others. Hence, while there is but one goal to be reached, the paths to this point will not all be identical; some will be rougher and some longer than others, and different means may be required to attain the common field of activity.

It is a truism that large committees produce small results. The civil engineers recognize this in turning over their contemplated work to an executive committee. Might it not be economical of time and labor if the other societies, if asked to coöperate with the civil engineers, go no further than appoint small committees who should await the preliminary report of the active committee?

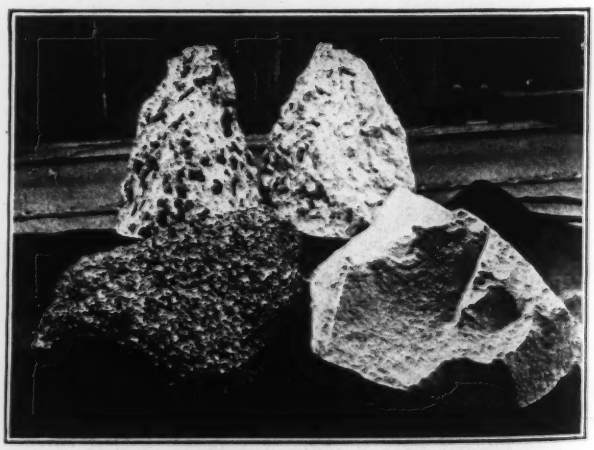
Such small committees could then consider this preliminary report and advise their board of directors how far coöperation was possible or advisable and what contitutional amendments would be required to give each society its maximum usefulness and the entire engineering profession its proper position in the economy of society.

Light Weight Concrete for Ships From Special Aggregate

Volcanic Rock Forms Basis For Concrete of High Strength and Weight Twenty Per Cent Lighter Than Normal

By James P. Nash
Testing Engineer, University of Texas, Austin, Tex.

TESTS recently made in the laboratory of the engineering division of the bureau of economic geology, University of Texas, show that certain aggregates, notably a volcanic scoria readily available in the Southwest, will give concretes of weights about 120 lb. per cubic foot and in 28 deg. tests compressive strength above 4000 lb. per square inch. Such material would



IN LEFT FOREGROUND, NEW MEXICO VOLCANIC ROCK. RIGHT FOREGROUND, QUARTZITIC SANDSTONE. CONCRETES FROM ROCK IN REAR

have marked and obvious advantages for concrete ship building.

The volcanic scoria used in these tests is from New Mexico, about 35 miles north of Las Cruses. Crushed between ¾ in. and ⅛ in. in size it weighs but 39 lb. per cubic foot loose. The specific gravity of the material being 1.50, it weighs solid 93.4 lb. per cubic foot. The volcanic rock screenings passing the ¼-in. screen weigh 78 lb. per cubic foot loose. This increase in weight of the screenings over the crushed rock is due to the fact that considerable pore space is lost by the finer crushing. Sandstone used in the tests, though somewhat heavier than the volcanic rock, also gave good results. It came from the property of the Texas Gravel and Sand Co., at Piedmont, Grimes County, Texas. An up-to-date crushing and screening plant able to produce 200 tons of crushed and screened stone per day is in operation, so that no further development is necessary to assure a constant supply for ship construction. From the fact that this material is only 80 miles from the port of Houston, Tex., it is believed that it offers numerous possibilities for the construction of concrete ships.

TABLE I. CHARACTERISTICS OF AGGREGATES USED IN TESTS

Material	Specific Gravity	Weight Lb. per Cu.Ft. Solid	Weight Lb. per Cu.Ft. Loose	Absorption, Per Cent.	Crushing Stg. Lb. per Sq.In.	Percentage Retained on ¼-In. Screen	½-In. Screen	¾-In. Screen	1-¼-In. Screen
Volcanic scoria	1.50	93.4	39	4.2	From 1,500 to 5,000	2	62	94	98
Indurated sandstone	2.20	137.0	61¾	3.4	5,440	0	40	71	100
Limestone	2.62	164.0	78	1.4	9,860	0		100	
Colorado river gravel	2.59		94½			0	40	70	100

The rock has a specific gravity of 2.20, giving a weight solid of 137 lb. per cubic foot. Crushed so that it will pass the ¾-in. screen and be retained on the ⅛-in. screen, it weighs 61¾ lb. per cubic foot. Screenings passing the ⅛-in. screen with the dust removed weigh 62 lb. per cubic foot Due to a smaller porosity, the sandstone screenings weigh less than do the screenings produced from the lighter volcanic rock.

The mixing and placing were done by hand, and the same consistency was obtained in every case except where noted in the tables. This was a mushy consistency; that is, when the concrete was tamped with a ⅝-in. rod water would appear on the top of the soft concrete. The specimens were 6 x 12-in. cylinders which were stored 21 days in wet sand, and then in air until tested. Where sand is noted the local Colorado River sand was used. This is a well graded coarse sand of excellent quality for concrete work. The gravel specimens were made from the local Colorado River gravel, except the gravel was graded to conform with the grading of the sandstone. The crushed limestone also approximated the grading of the volcanic rock, so that the results are directly comparable.

It is worthy of note that both the sandstone and the volcanic rock concrete are superior in strength to the gravel and limestone concrete at 28 days. In the case of the volcanic rock and screenings the concrete weighs 14.8 per cent. less, and has 12.5 per cent. more strength than the limestone concrete made at the same time and similar in every way. In like manner, the concrete made with the crushed sandstone and screenings weighs 10 per cent. less than the similar concrete made with gravel and sand and at the same time developed 12.4 per cent. greater strength. The weights for the concrete given in the tables are the weights of the concrete when it is removed from the molds, 24 hours after being poured. With the sandstone concrete the weight at 28 days was approximately the same as the one-day weight, the water absorbed in wet sand being given up when the specimens were stored in air. The volcanic rock concrete, however, averaged about 1 lb. per cubic foot heavier than at one day.

Using the sandstone crushed below the ½-in. screen and screenings of the same material, a concrete has been produced which weighs but 128 lb. per cubic foot. The strength of this concrete has not yet been determined, so the results are not recorded. In fact, the above results are only preliminary to a larger series of tests of this same material, which will include absorption tests and modulus of elasticity determinations.

St. Paul Meters Most of Water Sold

Of 42,250 water connections in St. Paul, Minn., 91.2% are metered. The percentage of receipts from the sale of water is almost exactly the same. During 1917 the average cost per service for maintenance was 10.7c. The daily consumption was 58 gal. per capita, but as 40% of the demand is supplied by individual artesian wells 73 gal. are supplied to each consumer. Gallons per tap are 377 and per meter 281 (domestic 141 and commercial 2290). It cost $34.15 per million gallons for the total maintenance and $66.06 if interest on bonds and sinking funds is added.

TABLE II. RESULTS OF TESTS OF CONCRETE SUITABLE FOR SHIP BUILDING
(Each compressive strength result is the average of from 2 to 4 specimens)

Coarse Aggregate	Fine Aggregate	Proportion	Water Used per Cent. by Weight of Mix	Sacks of Cement per Cu. Yd. of Laid Concrete	Weight of Concrete Lb. per Cu.Ft.	Compressive Strength Lb. per Sq.In. 7 Days	28 Days	Remarks
Volcanic rock, ¼ to ¾ in.	Sand passing ¼ in. screen	1:1:2	16.4	11.1	124.0	.....	5,100	
Volcanic rock, ¼ to ¾ in.	Sand passing ¼ in. screen	1:1:2 10% hydrated lime by weight	18.4	10.4	120.8	.....	4,100	More water used in this mix than necessary
Volcanic rock, ¼ to ¾ in.	Volcanic rock screenings, below ¼ in.	1:1:2	19.8	11.4	119.7	.....	5,060	
75% volcanic rock, 25% limestone, ¼ to ¾ in.	Sand passing ¼ in. screen	1:1:2	15.1	10.9	129.0	.....	4,525	
Crushed limestone, ¼ to ¾ in	Sand passing ¼ in. screen	1:1:2	11.3	10.2	140.5	.....	4,500	
Sandstone, ¼ to ¾ in.	Sand passing ¼ in. sieve	1:1½:3	12.8	7.57	132.0	1,730	3,560	
Sandstone, ¼ to ¾ in.	Sand passing ¼ in. sieve	1:1:2	15.3	10.4	131.75	2,140	4,100	
Sandstone, ¼ to ¾ in.	Sandstone screenings between ¼ in. and No. 48 sieve	1:1:2	15.3	10.75	128.75	2,785	4,990	
Gravel, ¼ to ¾ in.	Sand passing ¼ in. sieve	1:1:2	10.7	9.43	143.0	2,770	4,450	
Sandstone, ¼ to ¾ in.	Sand passing ¼ in. sieve	1:1:2	16.7	10.0	130.25	1,505	3,340	Too much water used in mixing
Sandstone ¼ to ¾ in.	Sand passing ¼ in. sieve	1:0.6:2.4	15.6	10.45	130.0	2,350	4,775	

Wood-Stave Pipe Built of Local Hemlock in North Carolina

By David R. Shearer
Electrical Engineer, Johnson City, Tenn.

DECISION was made in the summer of 1916 by the Boone Fork Lumber Co. to build a small hydro-electric plant in western North Carolina provided the work could be done without delay. The site was a deep and rocky gorge 14 miles from the railroad and almost

ONE OF THE CONCRETE BLOCK ANCHORAGES

inaccessible to wagons. The installation contemplated the use of a 30-in. pipe line about 1200 ft. long and designed to work under a head of 20 ft. at the intake and 144 ft. at the water wheel. The dam could be constructed of timber which was easily secured from the pond area and the machinery could be brought in by teams with ropes and tackle where necessary, so that the real problem was the pipe line. Because of the delays in securing pipe on the market and the difficulties of laying, it was decided to construct a continuous wood-stave line and to secure all the material locally, except the bands.

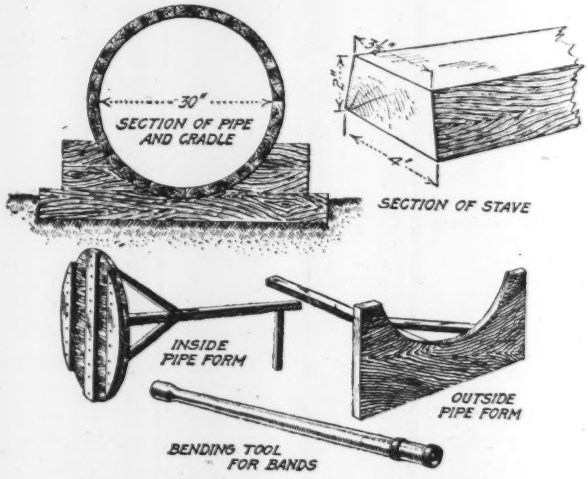
These bands were to be of round steel threaded on both ends, part of them 1 in. and part ¾ in., shipped without bending, to facilitate hauling on wagons. A small portable saw-mill was found and started to cutting 2 x 4-in. hemlock for the staves. The staves were left flat on the outside and inside and the edges bevelled to the proper angle on a small portable planer. The bevel was taken so that the outer edges came in contact before the inner edges, thus leaving a small crevice of about $\frac{1}{32}$ in. on the inside of the finished pipe. This was done with the idea that foreign matter would soon fill these spaces and assist in preventing leaks. By leaving the staves flat the pipe section was polygonal, but as the diameter was 30 in. this variation from a true circle was hardly discernible.

After the staves were cut and bevelled the ends were squared and a saw kerf cut in each end ¾ in. deep, in which was to be driven a 1½ x 4-in. piece of 12-gage sheet steel. As no dry kiln was available, the staves were used almost green, a condition which necessitated frequent tightening of the bands for two or three months after the pipe was placed in service. It would therefore have probably cost less to have erected a small kiln and thoroughly dried all the staves before use.

The bed was excavated for the line and the necessary trestles built, after which cross timbers were placed about 4 ft. apart. These were slightly hollowed where the pipe was to rest, but nothing further was done to them until the pipe had been assembled and banded, when they were ballasted; brace blocks were spiked on them and wedges driven against the pipe. The 1-in. bands were placed at the lower end of the pipe, spaced from 6 to 18 in. c. to c. The ¾-in. bands were spaced from 10 to 24 in. c. to c. At the points of greatest stress in the curves reinforced-concrete anchor blocks were formed around the pipe. These blocks were 8 x 2 ft. on top and were battered 2 in. in 12 inches.

The actual construction of the pipe was done by seven men: four put together the staves and three followed with temporary banding. At first bands were placed about 8 ft. apart, simply to hold the pipe in shape. A circular sliding form 1 in. smaller than the pipe was used to form up the circle on the inside and a sliding cradle held the bottom part of the pipe in place. After a little practice the men were able to lay about 100 ft. of pipe daily in spite of the rough nature of the ground and the difficulty of assembling the rough green staves.

After the entire line was put together the crew was sent over it again to complete the banding. The steel was bent partly on a heavy timber form and partly on the pipe by means of long socket handles which fitted



CONSTRUCTING PIPE LINE WITH SPECIAL TOOLS

over the ends of the steel rods. Two men would bend a band easily; then the lug was put on and the nuts run up.

The entire pipe was built and placed in service in less than 60 working days. At first there were many leaks and a few knots blew out, but after it was tightened a few times and small holes were plugged the leakage became much less and now after use the pipe is practically watertight. It is to be noted that at times the pressure surges run up to 20 lb. per square inch on this pipe in spite of the fact that there are two relief valves at the lower end, but the service has been satisfactory from the time it was placed in operation.

The writer had charge of the design and installation of this pipe and plant.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Merriman's Sanitary Engineering

ELEMENTS OF SANITARY ENGINEERING—By Mansfield Merriman, M. Am. Soc. C. E. Fourth edition. Revised with the assistance of Richard M. Merriman, Assoc. M. Am. Soc. C. E. New York: John Wiley & Sons, Inc., London; Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 244; illustrated. $2.

Twenty years have passed since the first edition of this well known college textbook appeared. With the development of the branches of sanitary engineering treated, and the demand for the book, successive editions have increased in size until the present or fourth edition is considerably larger and more comprehensive than the first one.

Opening with a general review of sanitary science which occupies some forty pages, the volume continues with chapters on water and its purification, water-supply systems, sewerage, sewage disposal, and the collection and disposal of refuse and garbage. The last-named chapter includes about four pages each on privies and cesspools and on street cleaning. As the larger part of the first chapter deals with very much the same topics as the remainder of the book, and since the concluding chapter is brief and has a fourth of its space gives to privies and cesspools, it will be seen that the volume is confined almost wholly to water-works and sewerage.

Although the two subjects just mentioned are the most important sanitary topics for general engineering students, yet the conception and practice of public health and sanitation have broadened so much in the past two decades, and there are now so many engineers connected with the local, state and Federal public health services, and responsible for health conditions in camps and industrial plants, that the scope of the next edition of the book might well be considerably enlarged. Thus the authors dismiss heating and ventilation with a few words and a remark that this is work for the architect rather than the engineer, whereas it is essentially engineering and has been so recognized for many years by the existence and activities of the American Society of Heating and Ventilating Engineers. Mosquito control may also be classed as a branch of sanitary engineering. The book barely mentions mosquitoes in connection with yellow fever and malaria, saying of the latter that *"probably* [italics ours] the infection of malaria is propagated by the help of mosquitoes."

Revision in the present edition, the authors state in their preface, includes the correction of all known errors, the substitution of some new problems or exercises for old ones, a new article on the Imhoff tank, a second new article on relatively new or not very common methods of sewage treatment, and new matter in 11 (of 85) other articles, "several of which have been entirely rewritten." These changes and additions are valuable but are insufficient to bridge the gap between the years 1906 and 1918.

Illustrations of deficiencies which, though minor, might easily have been made good are: Stopping with the London general death rate of 20.5 per 1000 for the decade 1881-90 in the field of mortality statistics, when the decrease might have been shown so much more strikingly by later figures; leaving the mention of Worcester, Mass., as the largest chemical precipitation plant in the United States, and ignoring the much larger city of Providence, which built similar works as far back as 1900; citing the Barren Island garbage-reduction works, New York City, as the largest in the country, when these were succeeded by a plant just off Staten Island in 1917; the entire omission of the activated-sludge process of sewage-treatment; and misleading statements under garbage disposal. One of the latter reads: "In large American cities the tendency has been to have a special plant for garbage cremation in which no other refuse is burned, but in the smaller cities the three classes (garbage, street sweepings and rubbish) are often burned in the same furnace." The reverse would be more nearly correct but, as a rule, large American cities reduce rather than burn garbage, and very few cities of any size attempt to burn street sweepings.

Considerable space has been given to a few of many minor omissions and commissions because they illustrate the difficulty or impossibility of bringing an old book up to date and making it worthy of being called a new edition by a mere cutting of plates here and there and the insertion of a few new pages. The book is worthy of thoroughgoing revision and considerable expansion. It is strongest in strictly engineering and hydraulic matters and weakest in dealing with present-day conceptions of public health and sanitation and in statistical and other illustrative matter inserted in the earlier editions but now out of date.

Finally, when another revision is made, it might be well to reconsider the statements on p. 12 and 13 to the effect that not health but disease is to be considered the normal state of man.

British Industrial Housing and Welfare

WELFARE AND HOUSING: A Practical Record of War-Time Management—By J. E. Hutton, Manager of Labor and Catering Department of Vickers Ltd.; Member of the Food Investigation Committee of the Ministry of Munitions. London and New York: Longmans, Green & Co. Cloth; 5 x 8 in.; pp. 192; 12 halftones and two folding plates. $1.50 net.

Based on the author's experience in housing, feeding and looking after the general welfare of a hundred thousand workers employed by a single industrial concern in the stress of war time, this small volume promises to be of great value to anyone concerned with similar problems, whether officially or as a student. Welfare supervision, temporary and permanent housing, catering, canteens, food values, motor transit, hospitals and medical services, works police, the woman worker's viewpoint (contributed by a woman) are considered in succession, and there is a sane and sympathetic chapter on industrial unrest. Appendixes deal with government regulations as to fitness certificates for workers, sanitary accommodations, washing conveniences, ambulance, first aid and minor injuries' services and provision and

protection of drinking water. Various forms are given as well as equipment specifications, menus, dieting values, and cost figures. The book should appeal to many in this country who suddenly find themselves confronted with the problems of meeting the needs of present-day war workers, in factory, shop, camp and shipbuilding plants.

Legal Bars to Municipal Activities

AMERICAN CITY PROGRESS AND THE LAW—By Howard Lee McBain, Dorman B. Eaton Professor of Municipal Science and Administration in Columbia University. New York: Lemcke & Buechner. Cloth; 6 x 8 in.; pp. 260. $1.50.

Absence of state authorization of municipal activities on the one hand and constitutional prohibitions on the other have often barred municipal projects. In the readable volume before us the author examines the "more important rules of law that are involved in some of the forward-looking movements in American cities."

The main topics considered are home rule, the breaking down of the rule of strict construction of municipal powers, extension of the police power as illustrated by smoke and billboard ordinances, building heights regulation, zoning and excess condemnation as elements of city planning, municipal ownership of public utilities, control over living costs, municipal recreation and the promotion of commerce and industry by such means as the development of water power, advertising the city, and financial aid to private enterprises.

The book will repay reading by those who wish an up-to-date presentation of the subject indicated by its title. The reader would have been helped by a concluding chapter of a generally summary character, and also by more comprehensive summaries than are now given at the close of some of the chapters.

Theory of Landscape Design

AN INTRODUCTION TO THE STUDY OF LANDSCAPE DESIGN—By Henry Vincent Hubbard, Assistant Professor of Landscape Architecture, Harvard University; Theodora Kimball, Librarian, School of Landscape Architecture, Harvard University. New York: The MacMillan Co. Cloth; 9 x 12 in.; pp. 406; illustrated. $6.

Earlier books on landscape architecture have passed hastily over the basic principles of design, or have taken them up piecemeal in connection with the practice of the art. This one outlines the theory on which the successful practice of the art depends. It is written primarily for the designer, and secondarily for those who wish to increase their power of appreciation of landscape and landscape design.

After a short introduction and a chapter on out-and-out theory, such topics as taste, ideals and the historic styles are taken up, with a seeming excess of abstract philosophical terms. There are then separate chapters on landscape characters, effects and composition which are less abstract than the earlier ones. The treatment then becomes still more concrete, with chapters on natural forms (ground, rock, water, as elements in design), on planting and on such structural elements as buildings, sculpture, fountains, cascades, gates, fences, roads and paths. The body of the book ends with a long chapter on types of design according to uses, including gardens, estates, land subdivisions, parks and reservations. An appendix deals with professional practice, and with procedure in design. There is a sufficiently full selected bibliography. A useful detailed index is provided.

Remarkably well chosen and handsomely presented illustrations—which really illustrate—add much to the value and interest of the volume. All the illustrations in the text, and the plates accompanying the text as well, are reproduced from pen-and-ink drawings, which always harmonize with type matter better than do half tones. The very handsome half-tone plates are grouped at the end of the volume, thus giving not only a more pleasing effect than if scattered through the text, but also facilitating reference, since the plates of both classes are so numerous and so often mentioned in the letter press as to make it impossible to place many of them opposite the text references.

The one serious drawback to the use of the volume, aside from its bulk, is the great length of the type lines, which severely try the best of eyes. In the case of such a handsome-appearing book, one hesitates to urge that a double-column page, narrower margins and smaller type would have been more serviceable to the reader, but such is the plain truth. Even with smaller type the book could be read much more easily if printed in two columns, besides which smaller type and narrower margins would have made a less bulky volume. Artistically, the book might be pronounced almost perfect, but not if the highest art—at least in the useful arts—is to fit form to function, as the elder Olmsted declared. The chief function of the printed page is to convey information quickly and easily. An overlong type measure, like the one in this volume, makes reading laborious. Mawson's "Civic Art," reviewed in these columns June 13, 1912, is a worse sinner in length of type measure by nearly two inches, besides having a less pleasing page and being a more bulky volume. Authors and publishers of books on landscape architecture and town planning might well put more restraint on their strong tendency to yield to the artistic impulse in book format. Otherwise they are liable to sacrifice convenience to appearance, thus violating one of the fundamental principles which they are trying to inculcate.

It would be a mistake to dismiss so valuable a work with even minor adverse criticism on the form of presentation. The volume is a notable addition to the literature of landscape architecture. It marks a distinct advance in the working data of an art which, most happily, is rapidly growing in theory, in practice and in public appreciation in America.

Americanization Practically Considered

AMERICANIZATION: A Discussion of Present Conditions, with Recommendations for the Teaching of Non-Americans; A Report Made by Charles H. Paull to the Solvay Process Company, Syracuse, N. Y.: Free on Application to the Company Named. Paper; 6 x 8 in.; pp. 37.

Americanization is a term which has come into wide use within the past two years to convey in one attention-compelling and inspiring word an idea of the increasingly widespread efforts which are being made to convert foreigners into worthy citizens or fit subjects of citizenship. These efforts are not new and some of them are prompted by not entirely unmixed motives, but they have been broadened, deepened, humanized and accelerated by the many new conditions and problems created or brought into prominence by the world war.

Among the most earnest and effective students and promoters of Americanization are a fast growing num-

ber of captains and lieutenants of industry. Proof of this is afforded by the interesting and valuable report noted above. The report is based on visits to industries and educational agencies in Massachusetts, Rhode Island, New York, Pennsylvania, Ohio and Michigan, and on suggestions from "experts in labor and education." Deductions from the survey, instead of the data gathered, are presented in readable form. Less than three pages is devoted to a series of 19 "recommendations for a school of non-Americans connected with the Solvay Process Company."

The report should interest a large percentage of the readers of this journal, both because of its practical relation to various engineering and manufacturing industries and because of its humanitarian and patriotic appeal. It may be had for the asking.

Unique Irrigation System Described

An extensive irrigation system in which all the water is pumped from wells, collected in redwood and in concrete pipe, passed through a concrete-lined canal, repumped, passed through a reinforced-concrete canal, and finally distributed through riveted steel pipe, is described in an irrigation ditch edition of the Lindsay (Cal.) *Gazette* of June 7. This unique system was built by the Lindsay-Strathmore Irrigation District, of which Stephen E. Kieffer, San Francisco, is chief engineer. E. C. Eaton, Lindsay, Cal., who was resident engineer for the work, is now superintendent of the system.

The Deepest Well in the World

Under the title, "The Deepest Well in the World and the Next Deepest in America," Dr. Israel C. White, state geologist of West Virginia (Morgantown, W. Va.) has described (1) a well 7386 ft. deep put down by the Hope Natural Gas Co., eight miles from Clarksburg, W. Va., and (2) a well 7248 ft. deep owned by the People's Natural Gas Co., and situated five miles from McDonald, Penn. The paper, which has been printed as an illustrated pamphlet of 22 pp., was presented by Dr. White before the Natural Gas Association of America last May. The second of the two wells described is said to be the third deepest well in the world.

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be secured without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or in case of books or papers privately printed, then to the author or other persons indicated.]

CHEMICAL AND BIOLOGICAL SURVEY OF THE WATERS OF ILLINOIS: Report for 1916—Edward Bartow, Director. Paper; 6 x 9 in.; pp. 190; illustrated.

In addition to an account of the routine work of the year, this report contains considerable data on Illinois water-supply and a number of University of Illinois theses on allied subjects. Among the theses is one by F. W. Mohlman on "The Activated-Sludge Method of Sewage Treatment." Other theses deal with bacterial purification of sewage, the effect of gashouse waste on the biochemical oxidation of sewage, and radioactivity of Illinois waters. A separate paper by W. R. Gelston gives operating results derived from the workings of the new water-purification plant at Quincy, Ill.

CITY MANAGERS' ASSOCIATION: Fourth Yearbook; Proceedings of the Society, Nov. 19-21, 1917. Achievement Reports—Auburn, Me.: The Secretary of the Association. Paper; 6 x 9 in.; pp. 126; illustrated.

Besides the proceedings of the 1917 convention this pamphlet contains portraits of more than fifty city managers, notes on "achievements" under the city manager plan, and a list of city-manager cities up to May 15, 1918, giving population, date in effect, name of manager, date of appointment and salary.

COMMISSION OF CONSERVATION, CANADA: Report of the Ninth Annual Meeting at Ottawa, Nov. 27-28, 1917—Ottawa, Canada: The Commission. Paper; 6 x 10 in.; pp. 257; illustrated.

CONCRETE ENGINEERS' HANDBOOK: Data for the Design and Construction of Plain and Reinforced Concrete Structures—By George A. Hool, S. B., Professor of Structural Engineering, The University of Wisconsin, and Nathan C. Johnson, M. M. E., Consulting Concrete Engineer, New York City; assisted by S. C. Hollister, B. S., Research Engineer, Corrugated Bar Co.; with Chapters by Harvey Whipple Adelbert P. Mills, Walter S. Edge, A. G. Hillberg and Leslie H. Allen. New York: McGraw-Hill Book Co., Inc., London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 860; illustrated. $5.

CONSERVATION COMMISSION, STATE OF NEW YORK: Fifth Annual Report, 1915—Albany, N. Y.: The Commission. Cloth; 6 x 9 in.; pp. 517; illustrated.

Water-power and storage, gaging station records, decisions on water-supply applications, public lands and forests are the chief subjects reviewed in this belated report.

THE FINANCING OF PUBLIC SERVICE CORPORATIONS—By Milton B. Ignatius, LL.M. of the New York Bar, Assistant to General Valuation Counsel, New York Central Lines. New York: The Ronald Press Co. Cloth; 6 x 9 in.; pp. 456. $5.

This book covers a subject of which engineers generally know all too little, and the author appears to know his subject. "Capital Stocks," "Funded Debt" and "Capitalization," the three principal parts of the book, each of which is subdivided into a number of chapters, give an idea of the scope of the volume.

THE FUNDAMENTALS OF MECHANICAL DRAWING—By Richard Shelton Kirby, C. E., Assistant Professor of Drawing and Descriptive Geometry in the Sheffield Scientific School of Yale University. New York: John Wiley & Sons, Inc. London. Chapman & Hall, Ltd. Cloth; 10 x 7 in.; pp. 83; illustrated. $1.50.

Intended for first-year college work. Several hundred "drill problems in the elements are provided."

GROUND WATER FOR IRRIGATION IN LODGEPOLE VALLEY, WYOMING AND NEBRASKA—By Oscar E. Meinzer. Washington, D. C.; U. S. Geological Survey. Paper; 6 x 9 in.; pp. 69; illustrated.

HEATING AND VENTILATION—By John R. Allen, Dean of the Department of Engineering and Architecture, University of Minnesota; M. Am. Soc. M. E., and J. H. Walker, Superintendent of Central Heating, The Detroit Edison Company. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 6 x 9 in.; pp. 268; illustrated, $3.

PETROLEUM, ASPHALT AND NATURAL GAS: Bulletin No 14—Kansas City, Mo.; Kansas City Testing Laboratory. Leather; 5 x 8 in.; pp. 232; illustrated. $2.

A handbook designed for "anyone interested in the production, refining, selling, uses and technology" of the materials named in the title.

SCOPE AND APPLICATION OF THE NATIONAL ELECTRICAL SAFETY CODE—Washington, D. C.; Bureau of Standards. Paper; 7 x 10 in.; pp. 84.

SOUTHERN PINE IN RAILROAD CONSTRUCTION— By Thornton A. Green, Special Representative, Southern Pine Association at Washington, D. C.: Address the Author as Above. Paper; 6 x 9 in.; pp. 34.

Preliminary result of a study undertaken to find "how the substitution of steel, concrete, etc., for wood could be checked and how the Southern pine orders by the railroads could be increased." Devoted chiefly to efforts made to increase use of Southern pine in freight cars and to specifications and dimensions for such material. There is also a brief section on laminated construction for barges. Further studies "will include timbers for trestles and general work, including material for immense car repairs that will include large orders for sills." The report was presented to the New Orleans meeting of the Southern Pine Association, May 2.

STATISTICAL ABSTRACT OF THE UNITED STATES, 1917—Washington, D. C.; Superintendent of Documents. Cloth; 6 x 9 in.; pp. 787; 40c.

SURVEY OF NORTHERN AND NORTHWESTERN LAKES; April, 1918—Detroit, Mich.: U. S. Lake Survey Office. Paper; 8 x 10 in.; pp. 513; illustrated.

TEST OF A FLAT SLAB FLOOR OF THE WESTERN NEWSPAPER UNION BUILDING—By Arthur N. Talbot, Professor of Municipal and Sanitary Engineering and in Charge of Theoretical and Applied Mechanics, and Harrison F. Gonnerman, Research Associate in Theoretical and Applied Mechanics. Urbana, Ill.: University of Illinois. Paper; 6 x 9 in.; pp. 52; illustrated. 20c.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY: Surface Water-Supply of the United States, 1916—Nathan C. Grover, chief hydraulic engineer. Paper; 6 x 9 in. At prices named below, from Superintendent of Documents, Washington, D. C. No. 431: Part I. North Atlantic Slope Drainage Basins. C. C. Covert, C. H. Pierce, and G. C. Stevens, district engineers. Prepared in coöperation with the States of Maine, Vermont, Massachusetts and New York. Pp. 171. 15c.

No. 437: Part VII. Lower Mississippi River Basin. Robert Follansbee, district engineer. Pp. 47; illustrated. 10c.

No. 426: Southern California Floods of January, 1916, H. D. McGlashan and F. C. Ebert. Prepared in coöperation with the State of California. Pp. 78; illustrated. 15c.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Heavy Motor Trucks and the Highways

Sir—The editorial in *Engineering News-Record* of June 13, entitled "Sound Development of Highway Transportation," calls renewed attention to a matter, the economic and financial importance of which has been but partially recognized and appreciated by engineers, and scarcely at all by the public

The necessity that has arisen during the war for the employment of mechanical power trucks on the highways for military and commercial purposes has brought more prominently to our attention the whole subject of the use of such trucks on our roads, and should serve to impress upon our minds the importance of a thorough and prompt study of the whole subject. The enormous increase in the use of power trucks that war conditions have brought about, and the large amount of capital that has been and is being invested in their manufacture, will place the truck interests, at the end of the war, in a position of power and influence that may be difficult to control, if control shall be found necessary. The fundamental question that must be decided sooner or later will continue to be, "Shall the use of heavy power trucks on the highways be prohibited, or shall the highways be so constructed as safely to permit their general use?"

By the term "heavy power trucks," as used in this letter, I refer to trucks of a rated load capacity of more than four tons.

Our experience has now clearly shown that even our best present highways are quickly destroyed by the excessive wheel loads and high speed of these trucks, and an answer to this question ought to be found without delay. If it can be conclusively shown by satisfactory evidence that the use of these trucks on the highways is, in normal times, necessary for the accommodation and promotion of the commercial and industrial interests of the country at large, and therefore beneficial to all classes of the people to an extent that will justify the enormous expenditure required, there can be but one answer. If, on the other hand, it cannot be shown conclusively that such an expenditure will yield a reasonable profit on the investment, or if it appears that provision for the use of heavy trucks will benefit a comparatively small class at the expense of the great mass of the taxpayers who must pay for the building of our public roads, a different answer is warranted. There is undoubtedly much to be said on both sides of the question. It needs careful, scientific and economic study and investigation, which so far it has not received. The arguments presented have been mostly those of special interests, the manufacturers and salesmen of trucks, and the often ill considered views of the good roads enthusiasts. The arguments on the other side have not been fully and properly presented to the public. Particularly, the enormous cost of building highways of the character that will be necessary to withstand the traffic of heavy power trucks has not been fully realized. Such a truck, with a rated capacity of 7½ tons and its normal load, imposes a rear wheel pressure of from 16,000 to 22,000 lb. upon the road surface, compared with, say, 2000 lb. by the ordinary two-horse wagon. The wheels of the truck are also of less diameter than those of the wagon. While the solid rubber tires of the truck serve to spread the concentrated load over a larger area, and are less severe in abrading the road surface than steel tires, the unit pressure on the surface is still in excess, and the load to be carried by the foundation and subfoundation is very much greater. The higher speed of the power vehicle is also an important factor in its effect upon the road surface and foundation. I have spoken of a 7½-ton truck, but it is reasonably certain that much heavier ones will be used. If power transportation on the highways proves economical at all, the economy will obviously be increased with the load capacity of the vehicle (at least up to a certain limit), and there will be an insistent demand that the use of 10- or 12- ton trucks be permitted. In fact, many such are in use today. The arguments that have led to the constant increase in the weight and capacity of railroad cars and ships would doubtless be equally patent in the case of power trucks.

To provide a highway capable of carrying such loads without rapid deterioration would call for a roadway surface approximating that of our best city pavements, and a concrete foundation from 50 to 100% stronger and more rigid than is now found adequate for city streets.

Such a roadway 20 feet wide (and no less width would be sufficient) with its incidental items would cost at pre-war prices not less than $40,000 per mile. This does not include the reduction of gradients now considered satisfactory, which the truck interests might with good reason demand.

There are said to be more than 2,000,000 miles of public roads in the United States, of which some 235,000 miles were reported as "improved" at the end of 1914. If we assume that 8% of the whole would have to be built or rebuilt, as main or secondary roads, in order to carry out a scheme of general heavy truck use, at an average cost of $25,000 per mile, the total first cost would be $4,000,000,000, or about $40 per capita for the whole population of the country.

Now, I do not believe that the people at large who must be taxed for the cost after the war, when the country will be more or less impoverished, understand that the construction or reconstruction of our highway system, to fit it for the use of heavy power trucks, would involve anything like so great an expenditure, and there is every reason to believe that when they fully realize what it involves they will be unalterably opposed to any such scheme.

The assertion, often made, that only a very few of our main highways would have to be so improved is unsound. To serve satisfactorily the purpose of transportation, distributing and delivering their freight, the trucks must have free range. They would have frequent occasion to use the secondary and local roads, and these eventually must be designed and built with such

use in view, though not necessarily of a strength and quality equal to those of the main lines.

Arguing from the present congested condition, due to the war, of rail and water transportation, it is asserted that these agencies have broken down and can no longer furnish the facilities that our expanding business demands. Such an assertion is at least premature. It will hardly be denied that under normal conditions it is *possible* for the railroads and waterways to enlarge and extend their capacity and facilities so as to meet fully any probable demands. Their past history furnishes ample evidence that with encouragement and fair treatment they will gladly do so; their own interests impel them to do so. Business sanity should lead the country to a careful consideration of what may be done in this direction, before launching upon a scheme to spend billions of dollars for what, at best, may prove a doubtful substitute.

For it is reasonably certain that even with perfect highways and the possible improvements and economies in the construction and operation of trucks that may be expected, the trucks will never be able to compete in ton-mile cost with the railroads for hauls of any considerable distance. They will have obvious advantages for short hauls, where terminal and delivery expenses cut a considerable figure in the total cost, and where very prompt handling is important, but for this kind of service a lighter class of trucks, not exceeding three or at the most four tons capacity, will doubtless prove most economical.

If, however, it shall eventually be found that the steam railroads and the waterways are inadequate, and the highways must be resorted to, it may be worth while to consider whether the construction of enormously expensive roadways is the best solution of the problem.

One possible substitute would be the construction, along the sides of the roadways,, of light industrial railroads for the use of commercial vehicles. Most of our highways are now—or could be, readily and cheaply—graded to such width as to permit the building of a single track on each side of the roadway proper. The cost of such a single track, ample for the use of trucks up to 15-ton capacity, would probably not exceed in normal times after the war $10,000 per mile, or $20,000 per mile for the two tracks.

Assuming that the roadway for ordinary business or pleasure travel could be built for $12,000 per mile, the total first cost would still be less than that of a roadway adequate for the trucks. The truck wheels could be constructed with steel treads and flanges placed on the inner sides of the rubber tires, of such radius that they would not interfere with the operation of the trucks upon ordinary roadways, and portable switches or turnoffs could be carried, enabling the trucks to leave the rails and take to cross or diverging roads or streets where necessary. Many of these details that cannot be dealt with in a letter like this would have to be worked out carefully, but from some study of such a scheme I believe it to be practicable. Aside from first cost, there are many arguments in favor of the plan, a few of which may be briefly mentioned:

1. The roadway would be less congested and left free for its normal traffic.

2. The tractive resistance of the trucks on steel rails would be much less than on the best roadway surface, thus economizing the power to be expended.

3. The trucks could safely operate at a higher speed than on the roadway, for the reason that they would not be obstructed or delayed by the roadway travel.

4. The cost of maintaining the roadway would be reduced and its life greatly prolonged.

5. With the trucks removed from the roadway the danger of accidents to those using it should be materially reduced.

It is not unlikely, if the truck traffic promises to be anything like as large as its advocates predict it will be in the future, that private corporations might undertake to build and maintain the tracks, on the basis of a ton-mile tariff charge sufficient to make the investment profitable, while fair and reasonable to the patrons. The saving of power, the higher speed attainable and the freedom from roadway accidents would help to compensate for such charges, if they did not compensate wholly for them.

In any event it would be just and proper that the interests specially benefited by the construction and maintenance of such railroads should, directly or indirectly, bear a large share of the cost.

Whether the foregoing brief arguments and conclusions shall be deemed sound or unsound, the main purpose of the writer will be attained if this letter helps to call attention to the very great importance of the questions involved and the urgent need that they shall be discussed from an engineering and economic standpoint.

New York City. S. WHINERY.

Equal Payments to Liquidate a Debt With Interest

Sir—The method of determining the amount of equal payments to liquidate a debt with interest given in your issue of May 2, p. 871, is in error. It is based on the payment of interest on the amount paid and not, as it should be, on the amount remaining unpaid.

A proper formula for this method of payment can be deduced as follows, using the same nomenclature as in the article cited: P = principal; p_1, p_2, p_3, . . . p_n, portion of principal paid with each payment; a, amount of each payment; r, interest rate for the fixed period.

The first payment will be $a = p_1 + Pr$. Each principal payment will increase by the interest on the previous payment, so that $p_2 = p_1 + p_1r$, $p_3 = p_2 + p_2r$, etc., or $p_2 = p_1(1 + r)$, $p_3 = p_2(1 + r)$, etc.

Then $p_2 = p_1(1 + r)$, $p_3 = p_1(1 + r)^2$, $p_4 = p_1(1 + r)^3$, . . . $p_n = p_1(1 + r)^{n-1}$, and

$$P = p_1 + p_1[(1+r) + (1+r)^2 + (1+r)^3 \ldots + (1+r)^{n-1}$$

Summing this series, we have

$$P = p_1 + p_1\frac{(1 + r)^n - (1 + r)}{(1 + r) - 1}$$

From this p_1 can be found and $a = p_1 + Pr$ gives the value of a.

The value of a in the example given is $668.32, which gives the correct returns when actually figured by tentative payments.

L. B. MERRIAM,
West Palm Beach, Fla. Civil Engineer.

Sir—There are two rules in common use for computing partial payments, both of which may be found in

any grammar-school or business arithmetic. First there is the "merchants rule," which provides that the borrower pay interest on the principal from the date of the note until maturity, and that he be allowed interest at the same rate on all installments from the time of payment until the maturity of the note. Nothing could be more fair or just than this, each party paying at the same rate for what he gets from the other, interest being figured simple or compounded, according to agreement. The "United States rule" assumes that the interest on the entire unpaid principal becomes due at the end of each period of payment, and provides that it be first deducted from the amount of the payment, the remainder of the payment, if any, being deducted from the principal. This rule is identical with the merchants rule with the interest compounded. The United States rule is, therefore, superfluous and the merchants rule, proper form of interest being assumed (simple or compounded) correctly and completely covers all partial-payment problems.

It is interesting to analyze Mr. Shepard's development to discover the premises upon which his formula is based, the premises not being stated in the discussion. It is assumed that the reader has the original article before him. The equation

$A = p_1 + p_1r + p_2 + 2p_2r + p_3 + 3p_3r + \ldots p_n$

indicates simple interest, and the statement that the equal installments are represented by $p_1(1 + r)$, $p_2(1 + 2r)$, $p_3(1 + 3r)$, etc., is equivalent to the assumption that at the end of each period interest is due and must be paid on that part of the principal which is to be paid at that time, the interest on the remaining unpaid principal being carried over. Such a plan of payment would be unusual, and, from the writer's point of view, uncalled for. The result is some kind of a compromise between simple and compound interest.

Applying the merchants rule as given above to the example cited by the author, assuming that he intended to use simple interest, the results are as follows:

Simple interest on the principal for 29 periods at 0.5% per period = \$18,000 × 0.005 × 29 =	\$ 2,610
Principal	18,000
Amount	\$20,610

The amount of an installment of \$1 per period paid at the end of each of 29 equal periods, with simple interest at 0.5% per period = ½(1.14 + 1.00)29 = \$31.03.

The installment required to liquidate the debt with equal payments is \$20,610 ÷ 31.03 = \$664.196. The total payment required to liquidate the debt is 29 × \$664.196 = \$19,261.684, the net interest payment being \$1261.68. It will be noticed that the total payment required by this simple and universally used rule is less than by the proposed calculus method.

If interest is compounded at the end of each period, using the same rule, and taking formulas for compound interest from any handbook the amount of \$18,000 at 0.5% per period for 29 periods = $18{,}000\ (1 + 0.005)^{29}$ = \$20,801.25. The amount of an installment of \$1 per period paid at the end of each of 29 equal periods, with compound interest at 0.5% per period, is $[(1 + 0.005)^{29} - 1] \div 0.005$ = \$31.125.

The installment required to liquidate the debt with 29 equal payments is \$20,801.25 ÷ 31,125 = \$668.31. The total payment will be \$19,380.99, and the net interest, \$1380.99, as against \$1261.68 for simple interest. Ordinarily, the amount and the principal of an installment of \$1 can be taken directly from interest tables, without the use of formulas, but the writer has no table for interest at 0.5%.

It can be positively stated that economy in the payment of interest cannot be effected by inventing new methods of computation. In the present case, where the debt is to be repaid by equal installments, the amount of each installment is definitely fixed as soon as the rate and the plan of interest are agreed upon, and any correct method of computation will give the same result. It is possible, of course, to agree to some arrangement, that suggested by Mr. Shepard, for example, which will give a result intermediate between simple and compound interest, but the logic or necessity of such an arrangement is not apparent.

JULIAN HINDS,
Assistant Engineer, U. S. Reclamation Service.
Denver.

[Other correspondents have offered similar solutions of Mr. Shepard's problem.—Editor.]

Use Nearby Aggregate for Concrete

Sir— While New England faces a serious coal shortage because of lack of transportation facilities, one sees a reinforced-concrete bridge under construction, the specifications of which call for trap rock for the aggregate.

This material must be transported by rail 50 or 60 miles and carload after carload (coal cars) is being unloaded for use in the bridge construction. Within an eighth of a mile of the bridge location is a ledge of as fine material for use as aggregate as ever was blasted out of the earth's crust. The use of this material would have saved the coal cars and transportation for the sorely pressed people of New England, besides saving the transportation expense and the cost of extra handling to the state.

The engineer under whose direction the specifications were drawn might have used the advantage of his position to further the cause of conservation by a practical and very public example.

A. A. YOUNG.
Jewett City, Conn.

Experiments Prove Trench Fever Spread by Lice

Scientific proof that trench fever is a germ disease, transmitted by trench lice as hosts, is given in a cablegram from General Pershing to Secretary Baker, published recently. Sixty-six noncombatants, whose names and addresses are given in the cablegram, volunteered for the necessary tests, which were conducted by the Army Medical Corps. Some of these men were inoculated with blood from trench fever victims and others were subjected to bites from lice taken from trench fever cases. A large percentage of the men in both cases contracted the disease. For control purposes, a third group of men were subjected to bites from lice taken from healthy men. The results were negative.

HINTS FOR THE CONTRACTOR

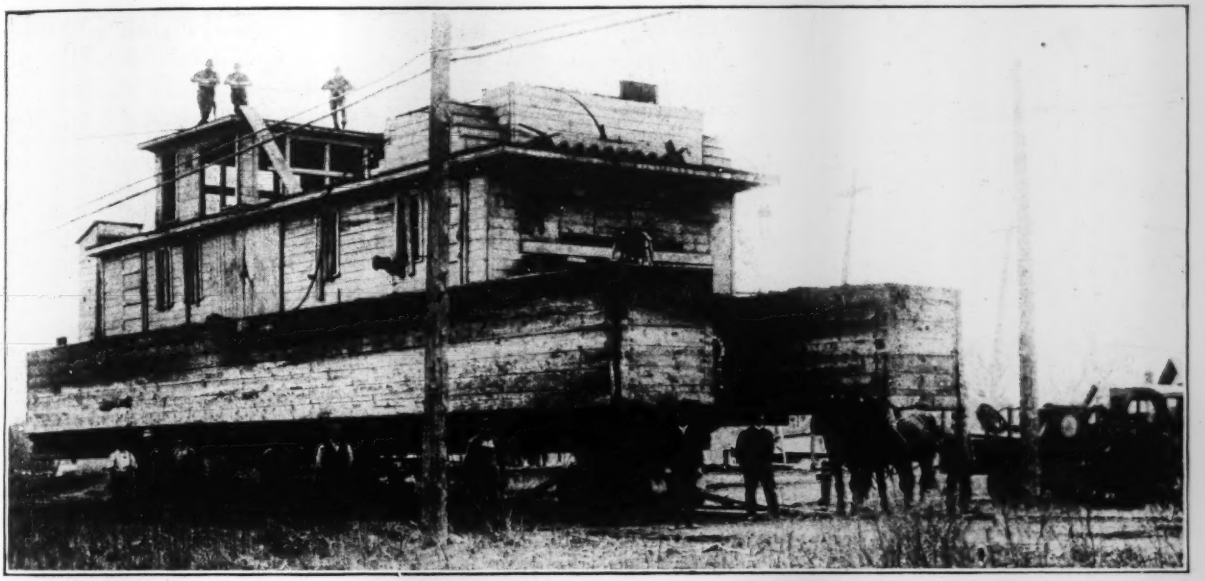
DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Move 180-Ton Dredge 4½ Miles Through City Streets

OVERLAND transport of a large hydraulic dredge had to be resorted to this spring at Minneapolis, in order to save the time and money incident to dismantling and rebuilding. The Northern Dredge and Dock Co. had just completed a four-year contract for the Minneapolis Park Board, at Lake Nokomis, with an electric hydraulic dredge which it wished to use on a new contract at South St. Paul on the Mississippi River. There is no water communication between the two sites, and the company was ready to go to almost any length rather than dismantle the dredge, on account of the difficulties in getting the necessary timber, a great deal of which must be sawed specially, and in getting the timber transported after it was sawed. A special permit was obtained from the City of Minneapolis to move the dredge overland through the outlying streets, a distance of 4½ miles, and launch it in the Mississippi River from special ways at the city levee.

The dredge is 80 ft. long, 24 ft. wide and 28 ft. high. The steelwork, consisting of the A-frame gantries, spud hoist and ladder frame, was removed, reducing the weight to about 180 tons. The dredge was mounted on three trucks of eight wheels, each 30 in. in diameter and with 18-in. tires, and was moved on a track of 6 x 6 in. maple timbers with the ordinary house mover's windlass and team. The timber tracks were used over and over again, but in general lasted only about three days. The dredge was moved and launched in 38 days, the cost being about $10,000, which also covered the moving of the dismantled portions and the balance of the equipment, such as pontoons, pipe, rubber connections, etc. The machinery, motors, pumps, etc., were not removed.

In moving the dredge through the streets of Minneapolis five street car tracks and the main line of the Chicago, Milwaukee & St. Paul Ry. had to be crossed; the latter carries 72 passenger trains a day, in addition to freight trains and switching service.



THREE EIGHT-WHEEL TRUCKS CARRY 180-TON DREDGE THROUGH MINNEAPOLIS STREETS

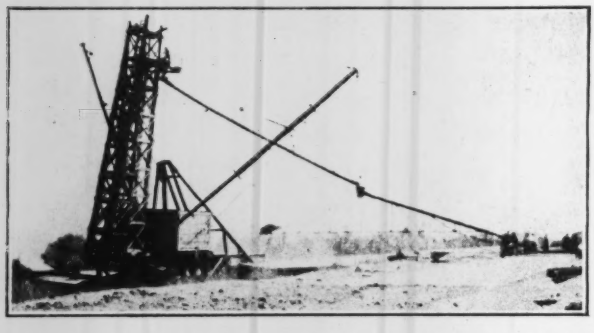
Cement Bags Tobogganed Down Roller Chutes

BAGS of cement at the concrete mixing plant for the new quartermaster's depot at Chicago are delivered 25 ft. from the conveyor head to the storage bin by board toboggans riding on roller chutes. All carrying of bags on the working floor is eliminated by this arrangement. The head of the belt conveyor which brings the bags from the car or the cement house stands about 2 ft. above the floor level and is 25 ft. from the bin top, which is covered with a grid of gas pipe. One end of the roller chute rests on the pipe grid and the other end is blocked up under the conveyor head. As the bags come up over the conveyor head they drop one by one onto 10 x 20-in. boards which a workman places on the roller chute one after another. The momentum of the bag as it shoots over the belt head sends the board tobogganing down the roller chute to land on the grid top of the cement bin. Here a workman cuts the bag tie and retrieves the board toboggan.

The grid top consists of 1-in. gas pipes laid one way across and 3 in. apart. The bags are untied where they fall and are left to drain out, eliminating nearly all emptying labor except a final shaking. The roller chute is made in 6- and 10-ft. sections of two 4 x ⅜-in. steel sides held 12 in. apart by steel rollers set like the rungs of a ladder and 6 in. apart. The rollers are 4 in. in diameter and 12 in. long and are journaled on ⅜-in. bolts through the sidepieces. The contractors for the work are the E. W. Sproul Co., Chicago, with C. W. Sproul as superintendent.

Floating Concrete Plant Builds Highway on Crown of River Levee

A FLOATING concrete plant, operating from the Sacramento River, Cal., is being used in constructing a road on Grand Island. The concrete is delivered to the subgrade through a counterbalanced swivel chute which is supported by a tower and boom. The plant,



POURING PAVEMENT SLAB FROM FLOATING PLANT

shown in the photograph, consists of a mixing barge, a derrick barge, a sand barge and a cement barge, all bound together with cables and moving along the bank as the work progresses. Materials are delivered to the construction plant by means of barges on the river.

Without rail transportation for materials and on a roadbed of deep sand, the construction problems were somewhat unusual. It was decided that the road, on the island itself, should be built on the levee, which averages 15 to 18 ft. above the adjacent tilled area and about 25 ft. above low water elevation in the river. For this location, it was found expedient to construct the pavement with the equipment mentioned above.

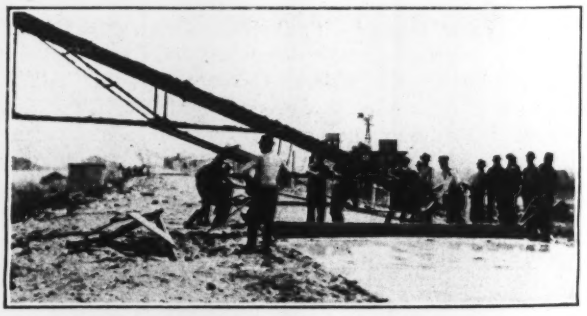
Before commencing the work, care was taken to see that the levee conformed to all requirements of the reclamation districts and the California Reclamation Board. A crown width of 25 ft., and slopes of three on one, for the river side, and two on one, for the water side, were approved. The elevation of the levee crown was established by the engineers of the State Reclamation Board, with a view to safety in times of extreme high water.

Having shaped up the subgrade, which consists entirely of sand, it has been found that the best method of compacting it is to soak it with water on the day previous to laying the concrete, until the water penetrates 12 to 18 in. into the sand where it meets the moisture from below. The surface is again watered heavily just ahead of the concrete crew. Under these conditions the sand subgrade will support the weight of a man almost without indentation. The large amount of water in the sand also prevents an excessive absorption of water from the concrete during the first few hours of setting.

The mixing barge, for pouring this pavement, contains a steam engine-driven hoist, winding drums and a 1-yd. mixer, bunkers for rock and sand with a combined capacity of 100 tons, cement platform and water pumps and water storage. The full capacity of the outfit was rated at 200 cu.yd. per day, which would give about 800 lin.ft. of road, but to a recent date the best day's work had been about 544 lin.ft. One of the difficulties was that the mixer had a tendency to slop over with a full charge. On this account the charge was reduced to a four-sack batch containing about 22 cu.ft., and this cut down the output.

Sand is delivered by barge from a point on the river about 15 miles north of the work, where suitable materials were found in the river bed. Tests on 1:2½ briquets, which were made with the sand developed over 2500 lb. per square inch in a 28-day period. The concrete mixer delivers the 1:2½:5 mix to a skip which is elevated to the top of an 80-ft. tower erected on the barge, and there dumps into a chute which delivers the concrete to the roadbed by gravity. The templet used to spread and tamp the concrete is shown in operation in the photograph. The upper section of the chute is supported and swung to position by a boom on the barge. The lower section of the chute is supported on a counterbalanced steel truss; which is attached to the upper chute by means of a swivel joint. By the use of this swivel connection, an operating radius, covering 60 ft. of road, is afforded from one position of the barge. With this arrangement, concrete can be delivered directly from the barge to the pavement along its entire length.

The work was started at the upstream end, and as it progresses the group of barges is eased downstream as required. The derrick barge is constantly unloading



DELIVERING, SPREADING AND TAMPING CONCRETE

sand and rock from delivery barges to the bunkers on the mixing barge. Cement in slings is lifted by the same derrick to the cement platform.

The highway alignment is made up of a series of very gradual curves, superelevation being provided on the sharper ones. Specifications require the concrete surface to be finished by hand with steel floats, which give practically a sidewalk finish. Two 2 x 8-in. redwood

header boards are left permanently in place at the edges of the concrete, secured by stakes and anchored to the concrete by 20-penny nails driven through from the outside.

The contract for the first section of the highway, 13.25 miles in length, was awarded to the Healy-Tibbitts Construction Co., San Francisco, at a price of $7.95 per cubic yard under terms whereby the county furnishes the cement. The pavement is 16 ft. in width and 5 in. thick. The expense of moving camp is small, as a tug and motor boat are required in connection with the work. Laborers are housed on a camp barge.

General supervision of the work rests with the Sacramento County Highway Commission, of which R. M. Morton is chief engineer. W. H. Stearns is resident engineer on the work and W. J. Graves is superintendent for the contractor.

Rock Channeler Cuts Starting Groove for Sheet Piling

A STARTING groove cut by a rock channeler permitted steel sheet piling to be sunk through hardpan overlying a sand bed, at the Junction Dam, Wellston, Mich. The purpose of the sheeting was to cut off flow of water through the sand. It was found in several places to be impossible to drive the steel piles through the hardpan by ordinary methods. Here a rock channeler was employed to cut on the line of the sheeting a groove some 10 ft. deep in which to start the piles. An ordinary quarry channeler was used. It was fitted with a longer cutter with a flat bit about 4 in. wide at the cutting edge, but otherwise the machine and the method of operation were the same as for rock channeling. The dam was built for the Consumers' Power Co., by the Fargo Engineering Co., Jackson, Mich.

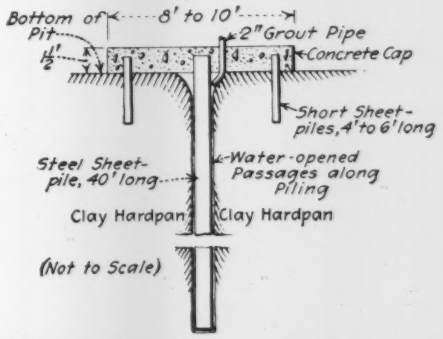
Combination Air and Water Pressure Grouting Machine Effective in Fine Sand

PRELIMINARY control and finally complete checking of artesian water rising along a line of steel sheeting at the Junction Dam, Michigan, were accomplished by a concrete cap and subsequent grout injection. Fine sand, ordinarily so difficult to penetrate with grout, was cemented by a special machine using alternately air and water pressure. Drill tests showed the sand to be well consolidated, and the result is attributed to the combined pneumatic and hydraulic method of injection.

Junction Dam is founded on a compact clay hardpan penetrated from below in places by sand strata and pockets. The sheeting consisted of steel piles driven to a depth of about 40 ft. below normal river surface to form a water stop. In driving this piling under the power house and spillway an artesian flow of water was encountered where sand strata were penetrated. The flow was considerable in volume and under some pressure, and needed to be shut off so as not to hinder construction operations and finally, of course, to seal the dam structures.

To control the flow the line of sheeting was capped with concrete anchored, as shown by the sketch, by short lengths of sheet piles set into the hardpan. While the concrete was setting the water flow was turned through pipes which were closed after the concrete had attained reasonable strength. Grout was finally injected through these pipes to close the passages opened by water along the sheeting and to consolidate the sand pockets.

Chief interest in the grouting operations lies in the machine used and the procedure of building down successive cemented strata. In the fine sand it was necessary to place the holes as close together as 3 or 4 ft. To prevent blowing out in an upward direction the



GROUT BEHIND SHEET PILE STOPS ARTESIAN WATER

grouting was worked from the top of the sand stratum downward. After saturating perhaps 1 ft. of sand with grout it was allowed to harden for a day or two. Then the cemented layer was drilled through, where necessary, and the grouting resumed. These processes were repeated until there was a seal 2 or 3 ft. thick.

The grouting machine used was designed by S. G. Hulse, construction engineer, Bedford, Penn. It differs from the ordinary tank grouting machine principally by the introduction of water pressure as well as air pressure, both controlled by valves so that varying proportions of each can be used, and so that air can be first used to expand the voids and hold them open while the grout is forced to place by water pressure. This combination of air and water injection proved remarkably effective in consolidating sand.

As has been proved frequently, the difficulty of grouting sand, especially if it contains water under pressure, is that such voids as exist are minute and the grout, on account of friction, will penetrate only a short distance from the pipe end. On this work, by using the air first, the small voids were seemingly collected by the packing of the sand into a smaller number of larger voids into which the water pressure was able to drive the cement particles. Air pressure to inject the grout was not tried, and it may be that it would serve as well as water pressure, but on this work, for some reason, the water seemed to be especially effective.

Another principal advantage found in the grouter here described was a device to prevent the balling up of more or less dried cement, which is a common trouble in grouting. This device consists of a central diaphragm horizontally across the tank. This diaphragm is perforated with numerous ¾-in. holes fitted with short brass tubes. The mixing action of this diaphragm prevents the formation of cement balls.

Referring to the grouting machine, the engineers for the Junction Dam state that no trouble was experienced

in keeping the machine clean, if it was washed out promptly, with water under pressure, when work was stopped for the day. The two machines used were both built for this work.

Hoops Made of Old Steel Rails Brace Circular Steel Cofferdams

By W. T. Penney
Guatemala City, Guatemala, C. A.

INTERIOR hoops, made of old steel rails, were used to brace the cylindrical foundation cofferdams of the Lenta River Bridge on the International Railway Co.'s line in Guatemala, built under the writers direction as contractor. Each foundation consisted of two circular units, 15 ft. in diameter, filled with concrete, placed directly against the 7-in. steel sheet piling. The piles were driven to 48 ft. below the bed of the river. One of the foundations, driven to grade, is shown in the illustration.

STEEL SHEET PILE CYLINDERS DRIVEN TO GRADE.

The piling was in lengths of 30 and 20 ft., each pile formed of a 30 and a 20-ft. length, placed end to end. In driving, these lengths were reversed alternately in order to break the joint. Driving proceeded until the piles had reached a depth of 48 ft. below the bed of the river, penetrating the soft conglomerate rock. The piles, though light, stood the driving with steam hammers through the sand and gravel very well.

After the cylinders were driven, they were excavated with ¾-yd. orange-peel dredges, working in the water. On account of the lightness of the pile sections, internal bracing, made in the shape of hoops, was used, Bracing of any other type would have interfered with the dredges making the excavation. The hoops were made on the ground of rail sections, being bent to the proper shape and placed 5 ft. apart vertically as the excavation proceeded. When the hoops were being placed it was necessary to unwater the cylinders, one 6-in. pulsometer pump being sufficient to handle the water. The first hoop was suspended with a ⅞-in. rod from the top of the cylinder and lower ones were suspended from one another in the same manner. After they were placed they were wedged lightly with the cylinders. Excavation proceeded to within 5 ft. of the end of the sheet piling, at which point concreting commenced.

The excavation having been made, the cylinder bottom was sealed with about 5 ft. of concrete and left overnight to harden. The concrete for sealing the bottoms was lowered into the water by especially constructed bottom dump baskets, and when it had hardened sufficiently the water was pumped out. As the concreting proceeded the internal hoop bracing was removed, the hoops being used in other cylinders; bracing enough for two cylinders was sufficient for the entire work. The sand for the concrete was taken from the interior of the cylinders, but the crushed rock was brought from a quarry nine miles from the bridge, no gravel being found in the river bed and very little in the cylinders.

Bridge Abutment Unwatered by Siphon

IN THE reconstruction of an abutment of a bridge at Lilio, Laguna Province, P. I., a long siphon made up of old artesian well drive-pipe was improvised to unwater the leaking cofferdam, according to information received from W. C. West, acting chief constructing engineer of the Bureau of Public Works of the Philippines. The river is a mountain stream with a rapid fall, and carrying a considerable flow. Its bed is composed of boulders and sand with very little gravel, and the percolation under the sand-clay cofferdam was such that a large gang of bailers had to work for hours every morning before any excavation could be made. No pumps had been provided, because the footings were to be carried only a short way below the river bed and water trouble was not anticipated.

The siphon was made up of an old 4-in. pipe which happened to be in the neighborhood. Its extreme length permitted the extension of the lower end downstream to an outlet below the level of the bottom of the abutment excavation. The 9-ft. upper leg was formed by heating and bending a length of the pipe. The siphon was started by lifting the upper leg and filling it with water by means of buckets, the outlet having meanwhile been closed by an improvised valve. The contrivance worked perfectly, unwatering the excavation in short order. By adjusting the foot-valve to limit the flow to the volume of the seepage, the water was kept easily within the sump into which the upper leg of the siphon was led.

An Effective "No Smoking" Notice

In a wooden shipyard of the Northwest, where 3000 men are working on rush schedule, it is important to impress on them the danger of breaking the rule which absolutely prohibits smoking. This is acomplished by a sign placed just inside the workmen's entrance, which reads, in large flaming letters: FIRE in this plant may put every man out of work. Help the management protect your job. NO SMOKING!

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Ask Rail Administration to Reconsider Rates

Highway Societies Request that Freight Increase on Road Materials Do Not Exceed 25%

Following an informal conference in Washington on July 10, the executive committees of the American Association of State Highway Officials and of the Highway Industries Association adopted a petition, which was presented by the committees to the Railroad Administration the following day, asking that order No. 28, which placed flat-ton freight rate increases on cement, brick, stone, sand and gravel, be modified so that a straight increase not exceeding 25% would apply. The petition presented reads as follows:

"The executive committee of the American Association of State Highway Officials and the executive committee of the Highway Industries Association, representing respectively all the state highway departments and National Association of Sand and Gravel Producers, National Slag Association, National Crushed Stone Association, Portland Cement Association, National Paving Brick Manufacturers' Association, National Association of Asphalt Block Manufacturers, in conference, represents:

"1. That the flat-ton rates presented by the Director General's order No. 28 imposes upon certain commodities—to wit, cement, brick, stone, sand and gravel, and other road materials—an undue and unjust proportion of the increased transportation cost;

"2. That said order imposes unequal, unjust and inequitable freight charges upon all materials used for highway construction, and unless modified and reformed so as to make said rates both equal and just will interfere with further road improvement throughout the entire country;

"3. That it is an obligation of the Government to distribute the transportation tax so that it will bear equitably on commodities and localities;

"4. That if a straight increase of 25% in commodities generally be fair it is unjust to select certain commodities and impose upon them increases ranging from 50 to 500 per cent;

"Wherefore, supplementing petitions already presented, we pray the Director General of Railroads that General Order No. 28 be modified so as to apply a straight increase of not exceeding 25% on road-building material.

"We further pray that the carriers under the Director General's control be authorized to refund on shipments moving subsequent to June 24, 1918, all charges collected in excess of 25 % above the previously existing rates."

In addition to this resolution, the committees urged relief for contractors who had entered into contracts for work prior to the promulgation of the recent freight advance orders, calling attention to resolutions adopted by the Highway Industries Association and previously presented to the railroad administration.

On receiving the petition, the representative of the Director General of Railroads advised the committees that the portion of the appeal asking relief for contractors could not be considered, and that there could be no distinction between contractors holding contracts executed prior to the promulgation of the increases and those holding contracts executed later. If any relief is secured it must be for a reduction in the rate itself or through state, county or municipal authorities. Decision on the main petition has not yet been rendered.

Joint Highway Convention Arranged for October

Arrangements have been made by the American Association of State Highway Officials and the Highway Industries Association under which the two organizations will hold a highway convention in the week beginning Oct. 6. The highway officials will hold their own meetings in the early part of the week and will then join with the Highway Industries Association in joint sessions for the discussion of papers and the highway situation generally.

Chicago is under consideration as the place of meeting, but announcement as to the place will be made later.

St. Louis Wants Bids for Garbage Disposal by Reduction

Bids for garbage disposal by reduction will be received Aug. 6 by the Board of Public Service of St. Louis. The city will collect the garbage and deliver it to two loading stations provided by the contractor. The plant must have a capacity of 400 tons a day and be located not nearer than a half mile to the city limits. The present contract will expire Sept. 1, 1920. The garbage of St. Louis is now disposed of by reduction in a plant owned by the Sanitary Reduction Co., whose contract expires Sept. 1. About 200 tons a day are now handled. The new bids will be on a tonnage basis. The United States Food Administration has urged that the proposals be for reduction rather than hog feeding, since a reduction plant is already in existence and glycerine, grease and tankage are so much needed.

Student Training Corps Plans Complete

Combined Military and Intellectual Instruction Open to Young Men Not Under 18

Details of the plan prepared by the War Department to offer to able-bodied college students over the age of 18 the opportunity to enlist in the military forces of the United States and to obtain training in the colleges which will prepare them for the more exacting forms of military service have now been completed. The plan was briefly described in *Engineering News-Record* of May 23, p. 1017.

The plan is an attempt to mobilize and develop the brain power of the young men of the country for those services which demand special training. Its object is to prevent the premature enlistment for active service of those men who could by extending the period of their college training multiply manifold their value to the country. If, however, the need arises for the services of these men in the fighting line, the terms of their enlistment are such that they can be called by the President on a day's notice. For the present it will be the policy of the Government to keep them in training until their draft age is reached.

WAR DEPARTMENT'S ANNOUNCEMENT

Commenting on the importance of special training, the War Department, in a recent announcement, says:

"This is a war in which soldiers are not only marksmen, but also engineers, chemists, physicists, geologists, doctors, and specialists in many other lines. Scientific training is indispensable. Engineering skill is needed by the officers who direct every important military operation and who control our lines of transport and communication. In the same way chemical and physical knowledge are in constant demand at the front as well as behind the lines, while the task of saving the lives and restoring the health of hundreds of thousands of wounded calls for the services of regiments of military physicians. The scientific training which prepares a man to fulfill one of these highly specialized duties and the more liberal training which helps to develop the qualities of leadership needed by the officer or administrator are essential elements of military efficiency."

For the purpose of developing men who shall have this combination of military and intellectual training the new corps has been created—to be called the Students' Army Training Corps. Voluntary enlistment in this corps is open to all able-bodied students in the in-

stitutions of collegiate grade who are not under 18 years of age. Students under 18 cannot be legally enlisted, but they may enroll and thus receive military training until they reach the age when they can legally enlist.

Training units will be organized in accordance with the needs of the army and the character of the institution. Most of them will be infantry units, though some schools will have heavy artillery and light artillery courses. There may be one or more cavalry units. Schools of medicine and engineering, to a limited number, will have specialized technical units.

THOSE ENROLLED TO BE EQUIPPED BY WAR DEPARTMENT

The boy who enlists in the Students' Army Training Corps will be a member of the army of the United States. He will be provided by the War Department with uniform and equipment, but will be on furlough status and will not receive pay. He will undergo regular military training as a part of his course during the college year, will attend a six weeks' camp for rigid and intensive military instruction with a private's pay, and will be subject to the call of the President for active service at any time, should the exigencies of the military situation demand it. The policy of the Government, however, will be to keep members of the corps in college until their draft age is reached, and the War Department will have the power to order such men to continue in college even after their draft age is reached whenever their work is such that the needs of the service—e.g., for doctors, engineers, chemists and the like—are such as to make that course advisable.

The Students' Army Training Corps will be administered by the committee on education and special training of the War Department, which will function as a section of the training and instruction branch of the war plans division of the General Staff. Competent officers and noncommissioned officers will be assigned to the various institutions to carry on the work of military instruction. To supplement the officers assigned by the War Department three special summer training camps are being held to train a limited number of picked students and members to assist in the work of military instruction.

These camps will be held at Plattsburg, N. Y., Fort Sheridan, Ill., and Presidio, Cal., for sixty days, beginning July 18.

Concluding the statement already referred to, the War Department says:

"The importance of this plan for combined military and collegiate training, if we are to meet in the future the urgent needs of the army for highly trained men, is so great that the War Department earnestly requests the colleges, councils of defense and other patriotic societies to coöperate in bringing it to the attention of the young men of the country and in urging them to do their part to make it a success."

Construction Division Engineers Reviewed by Their Chief

Concluding their drill for the season, the officers of the construction division of the War Department were reviewed July 11 by their chief, Brig. Gen. R. C. Marshall, Jr. Approximately 150 men, ranging in rank from lieutenant to major, were in line. As was to be expected from a group of men of such intelligence, the officers displayed remarkable proficiency in drill work and showed to advantage at the review. Those in the reviewing body were, in addition to General Marshall, Cols. Peter Junkersfeld, F. M. Gunby, J. N. Wilcutt, Evan Shelby, J. H. Alexander and Lieut. Col. Philander Betts. All of them except Col. Betts are shown in an accompanying picture taken just before the review.

OFFICERS OF CONSTRUCTION DIVISION, WAR DEPARTMENT

This picture was taken just before the review last week. From left to right the officers are: Colonels J. H. Alexander, F. M. Gunby, J. N. Wilcutt; Brig. Gen. R. C. Marshall, Jr.; Colonels Evan Shelby, Peter Junkersfeld.

Coroner's Jury Blames City For Fatal Collapse

Alleging contributory negligence on the part of both the builder and of the city building department, the coroner's jury looking into the collapse of the building under reconstruction at Sioux City, Iowa, on June 30, in which 38 persons were killed, has made some very radical recommendations as to the future conduct of the city's building department. As noted briefly in *Engineering News-Record* of July 4, p. 56, the building, occupied by markets and stores, collapsed in the middle of the day when a large number of customers were inside, and subsequently caught fire, with the fatal result indicated. The structures were very old and, according to the coroner's report, had brick walls in a state of disintegration, both the brick and the mortar being in very weak condition. The repairing consisted in cutting floor joists, lowering floors and attempted underpinning.

The coroner's jury found that the building inspection department made only a casual examination of the work, demanded no plans or specifications, and took the word of the contractor as to its safety. The jury has, therefore, recommended that fixing the responsibility for the deaths be undertaken by a grand jury and that "the council of the city revise its building ordinance at once in such a way as to provide for a rigid inspection of all buildings by thoroughly competent, technically educated and experienced inspectors, and revise its present methods of building inspection."

The city had a change of administration last January, and it is freely charged in the newspapers that the city building department was made the plaything of politics.

Fast Freight Service Opened On New York Barge Canal

Through freight service with all the commercial machinery common to railway freight service has been initiated by the United States railroad administration on the New York State Barge Canal, the operation of which the Government took over some months ago. A triweekly fast freight carload and less-than-carload service has gone into effect between New York and Buffalo, serving Albany, Troy, Amsterdam, Little Falls, Utica, Rome, Syracuse, Rochester, Lockport, Tonawanda, Niagara Falls and Buffalo. Ten deck-loading power freighters and two covered barges were acquired to form the nucleus of a new fleet. As the traffic develops and the demand for additional equipment arises, the service will be extended to other points and additional vessels acquired. Freight agents have been appointed and will be located at each of the above-named ports.

Uniform bills of lading, naming all the conditions and liabilities accepted by rail lines, will be issued and freight will be accepted subject to the rules and regulations relative to ratings, packings, etc., that are prescribed by current classification. Tariffs have been issued naming class and commodity rates between all points to be served. The rates, as noted in these columns some weeks ago, are the old railroad rates,

which are about 25% less than the present railroad rates. Tariffs will also be issued naming joint rates with connecting carriers, both water and rail. For the present the new boat line will operate only between Albany and Buffalo, transfer being made at Albany to the Hudson River Line.

As a part of the new freight service the Government has had built a 50-ft. spur at Troy, which connects the tracks of the Boston & Maine R.R. with the warehouse and dock of the barge canal at that point. This is the first actual track connection between railroad and canal, and will permit the ready transfer of freight between these two carriers The railroad administration is also building trestles at Ithaca on Lake Cayuga and Watkins on Lake Seneca, which can be used in loading barges with coal from the accessible fields.

Federal Government Takes Over New Jersey Canals

Another canal system has been added to the inland waterways now operated by the Federal Government. Under date of July 10 the Director General of Railroads issued an order, effective July 15, making G. A. Tomlinson, now general manager of the New York canal section of the United States railroad administration, general manager of New York and New Jersey canals. The effect of the order is that Mr. Tomlinson, in addition to operating the New York State Barge Canal, will operate for the Director General upon the Delaware and Raritan Canal and connecting waters such equipment as the United States railroad administration now has in its possession and control engaged in such operation and such additional equipment as may be assigned for that purpose. He receives the same powers of administration on the Delaware and Raritan Canal as he already has on the New York State Barge Canal.

The Delaware and Raritan Canal connects the Delaware and Raritan Rivers, is 44 miles long and has a navigable feeder, 22 miles additional. Up to the time the United States Government took over the railroads it was leased to the Pennsylvania R.R. and was little used. It is now intended to make it a working waterway between New York and Philadelphia, with a daily freight service, and as soon as possible proper equipment will be purchased and installed to that end.

Bids for Laying 72-In. Steel Water Pipe Wanted

Jersey City wishes bids until July 27 for laying the 34,590 ft. of riveted steel pipe between its Boonton reservoir and Watchung tunnel, noted in *Engineering News-Record* of July 11, p. 102. M. I. Fagen is director and C. A. Van Keuren is chief engineer of streets and public improvements. Clyde Potts, 30 Church St., New York City, is consulting engineer for the work.

Form United States Housing Corporation

Organization Similar to Fleet Corporation Created to Take Care of the Housing Operations

Following the precedent established by the United States Shipping Board in founding the Emergency Fleet Corporation, the United States Housing Corporation has been created to take over the functions now being performed by the bureau of industrial housing and transportation of the Department of Labor. A charter was taken out under the laws of the State of New York and the articles of incorporation provide for the issuance of 1000 shares of stock without par value. The executive officers of the corporation are, President, Otto M. Eidlitz; vice president, Joseph D. Leland; treasurer, George G. Box; secretary, Bert L. Fenner. These four, in conjunction with A. B. Kerr, John W. Alvord and William E. Shannon, serve as directors. The stock is held on behalf of the Government and the Secretary of Labor, who is credited with 998 shares, Mr. Eidlitz and Mr. Box having one share each. All of these men have been connected with the bureau of industrial housing and transportation of the Department of Labor.

The urgent deficiency bills just passed carry an appropriation of $60,000,000 for housing. This is the money which was authorized in a previous bill, $10,000,000 of which is to be used in the City of Washington, but the appropriation was not carried in the first act. In a later bill $40,000,000 more was appropriated, making a total of $100,000,000 to be expended by the Housing Corporation.

Scope of War Department's Education Committee Enlarged

When the committee on education and special training of the War Department was authorized last February its purpose was designated as that of "organizing and coördinating all of the educational resources of the country with relation to the needs of the Army." Under its authorization the committee has organized the training courses for mechanics, and is now forming the students' army training corps (details of which will be found on page 149 of this issue.

On June 28 the order creating the committee was amended, defining more particularly its scope. While its function originally defined covered theoretically all educational work of the War Department, actually there were instructional amendments of the orders; changes have been made in the draft regulations bringing the enlisted reserve corps under the committee. The amended order reads as follows:

"The Committee on Education and Special Training shall hereafter function as a section of the training and instruction branch, war plans division of the General Staff. Its functions shall be: To study the needs of the various branches of the service for skilled men and technicians; to administer a system of special training in colleges, schools and industrial plants; to represent the War Department in its relations with the educational institutions of the country; to supervise and administer military training in all colleges and civil institutions; to supervise and administer the furlough or enlistment in the enlisted reserve corps of technical students and teachers, in accordance with the provisions of Section 151 of the selective service regulations. The committee will be given such additional assistance, commissioned and civilian, and such additional office space, as may be necessary for the proper execution of its duties. The advisory civilian board appointed by the Secretary of War composed of representatives of educational institutions will continue to be associated with the committee."

Recommend Garbage Utilization in San Francisco

Garbage utilization at San Francisco has been recommended by a committee of five city officials, including E. P. Jones, assistant city engineer and Dr. William C. Hassler, health officer. The committee advises that householders be required to separate garbage from other city refuse; that the disposal of the material thus separated be by contract; and that bids for the work be invited. The plan of the committee appears to contemplate a single contract for disposal, under which the contractor would utilize the garbage by reduction or by feeding to hogs and would very likely burn the refuse, or at least the noncommercial portion of it, at the new incinerator, owned by the city. The committee advises that hotels and restaurants be permitted to continue to dispose of their garbage privately, but one member of the committee dissents from this proposition on the apparent ground that the city should get the benefit of the value of the hotel and restaurant garbage.

Drainage Contractors Appeal for Relief from Increased Costs

The Levee and Drainage Contractors' Association has issued an appeal for the relief of drainage contractors throughout the country, either through an increase in prices on pre-war contracts or entire suspension of all work being done at a loss and which was entered into before the present conditions of extremely high prices and shortage of both labor and materials. At the same time the association states that it is not the desire of its members to make any profit on pre-war contracts, but that it is desired only to obtain an increase sufficient to equal the added cost of completing work undertaken previous to present conditions.

In speaking of retained percentage ranging from 10 to 20% on contracts until they are entirely completed, the association states that this practice forces the contractor constantly to seek additional funds with which to carry on his work, and as the banks have restricted their lines of credit, especially to drainage contractors, on account of the dangerous conditions confronting them, it is almost impossible for contractors to borrow additional funds with which to complete work. It is pointed out that while the retained percentage in some instances is a statutory requirement, it can be offset by allowing advances on material and supplies which must be accumulated far in advance of their needs to enable contractors to continue the work, since present conditions will not permit definite assurance of shipments by producers.

Niagara Power Insufficient for War Needs

Both Water and Steam Sources Being Increased and Available Power Allotted by Government

War industries centering around Niagara Falls and Buffalo and extending into western New York are using all the available power there and are forcing increases both in the hydro-electric and steam-power plants. A recent report to the Secretary of War by Gen. C. Keller and Robert J. Bulkley, who have been supervising the supply of electrical power in western New York for the Government, gives the details of the allotting of power to various companies, mainly on the basis of the essential nature of the industries.

The two American hydro-electric plants at Niagara Falls were taken over by the Government in December, 1917, and their power distributed under Federal order to essential industries. One of the plants, during the past winter, devoted 74% of its power to direct war industries and 12% to transportation; of the remaining 14% only 2% went to really nonessential interests. The other company had 97% in direct war industry. In some cases power users deprived of power changed their product to one essential to the war and received power.

Regarding shortage in this district the report says:

"Under war conditions the power supply falls short of the demand by about 200,000 hp. This estimate is not based on new industries coming into the district, but is determined as the amount of power which could be absorbed by the industries now operating, were such a supply available. A large part of this amount would be absorbed without the addition of new industrial equipment by the users.

"Some of this shortage will be relieved next Fall by the proposed enlargements of the steam plants of the Buffalo General Electric Co. and the Niagara, Lockport and Ontario Power Co. These two companies are now making additions to their plants aggregating 62,000 hp. By means of a further development by the American hydro-electric power companies at Niagara Falls their existing supply of power, amounting to about 250,000 hp. will be increased by about 160,000 hp."

Work has already been started on the 66,000-hp. addition to the Hydraulic Power Co., on the American side of the Falls. Two 33,000-hp. units are to be installed at present, and in future, if permission for use of more water can be had, this will be increased to ten such units, making a total capacity, with the present units, of 450,000 horsepower.

In Canada the Ontario Power Co., now under control of the Hydro-Electric Commission of Canada, is being increased 50,000 hp., the increase to be available before the beginning of 1919. The Chippawa development of the Commission is well under way though its completion is two years in the future This plant is to have four 50,000-hp. units now and may have 100,000-hp. units, the largest ever attempted.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Sept. 2, Denver, and Sept. 3, Colorado Springs, Col.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS; Pittsburgh; Sept. 9-13, Baltimore.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS; 304 East Walnut St., Bloomington, Ill.; Oct. 2-4, Buffalo, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Boston.

The Pacific Highway Association of North America elected the following officers at the recent meeting in Maryhill, Wash.: President, Samuel Hill; executive officer, J. C. Potter, Portland; senior vice-president for Washington, E. A. Stuart, Seattle; for Oregon, Simon Benson, Portland; for California, Mrs. A. B. Spreckles, San Francisco, and F. W. Jackson, San Diego; for British Columbia, A. E. Todd, Victoria, and F. R. MacD. Russell, Vancouver; for Alaska, Falcon Joslyn, Fairbanks; for Yukon Territory, Alfred Thompson, Dawson; for Arizona, Dr. J. A. Ketcherside, Yuma.

The Michigan State Good Roads Association will hold its convention Sept. 2-4 at Detroit in conjunction with the state fair. A road school will be conducted the first day by F. F. Rogers, state highway commissioner, for the 2200 county and township road commissioners. The second day will be exhibit day, and papers will be presented on the use of machinery and materials. National speakers and foreign army engineers will be on the third day's program, while it is hoped to stage road building exhibits on a stretch of road in the fair grounds the fourth day. In the interest of a full exhibit of machinery, priority arrangements have been made with the Government to transport goods within the state one way free of charge. Willard M. Bryant, Kalamazoo, is field secretary of the association.

The Engineers' Club of San Francisco heard a talk on "Italy and the War," by Lieut. Bruno Roselli of the Italian Army, at its meeting on July 9. Lieutenant Roselli spent two years at the front.

The Engineers' Club of Columbus, Ohio, on June 28 discussed the future water supply of the city. Prof. E. F. Coddington, chairman of a committee on civic activities, presented the results of his investigations in graphic form. A committee on Americanization was appointed to coöperate with the Chamber of Commerce.

The Houston, Tex., Engineers' Club was addressed by E. E. Sands, city engineer of Houston, at the meeting of July 11. Mr. Sands spoke at length on "The Relation of the Engineer to the Public."

The Chicago Engineers' Club was addressed July 11 by William H. Blood, Jr., of Stone & Webster, on "The Construction of the Hog Island Shipyard," Mr. Blood addressed the weekly noonday meeting of the Chicago Association of Commerce on the same subject July 10.

The Washington State Association of County Engineers will hold its 14th annual convention in Seattle on July 24, 25 and 26, at the same time as the 12th annual convention of the Washington State Association of County Commissioners. There will be joint sessions of the two organizations as well as separate meetings.

The Detroit Engineering Society will hold its next meeting Aug. 10 It will consist of an inspection trip to the Ecorse plant of the Great Lakes Engineering Works, engaged in shipbuilding work for the Emergency Fleet Corporation. The arrangements for the trip are being made by George B. Turnbull of the executive committee of the society and a list of all members expecting to be present will be submitted to the Emergency Fleet Corporation officials for approval.

The Rochester, N. Y. Engineering Society held a special meeting July 8, at which an appeal for members to serve the Rochester district of the ordnance office production division of the War Department was made through Alfred M. Mosscrop, production manager of the local ordnance division. Sergeant Major Charles L. Haslett, British Royal Flying Corps, gave an il-

lustrated talk on "Aërial Photography." The illustrations showed the arrangements of trenches and the effect of high explosives. Sergeant Major Haslett is now an instructor at the United States School of Aërial Photography at Kodak Park, Rochester.

PERSONAL NOTES

J. HAROLD RAPP and Bernard Summer, Pittsburgh, have formed the firm of Rapp & Summer, structural engineers, with offices in the Fulton Building.

E. A. HADLEY, chief engineer of the Missouri Pacific R.R., has been appointed engineering assistant to the Federal director of the Southwestern region, with headquarters at St. Louis.

H. R. CARPENTER, assistant chief engineer of the Missouri Pacific R.R., has been appointed chief engineer of all the lines reporting to Federal Manager A. Robertson.

PROFESSOR HORACE R. THAYER of the department of structural engineering, Carnegie Institute of Technology, Pittsburgh, has been elected as the first president of the newly organized Authors' Club of Pittsburgh.

E. F. MITCHELL, chief engineer of the Texas & Pacific Ry., has been appointed chief engineer of that line and the other lines under the jurisdiction of Federal Manager J. L. Lancaster.

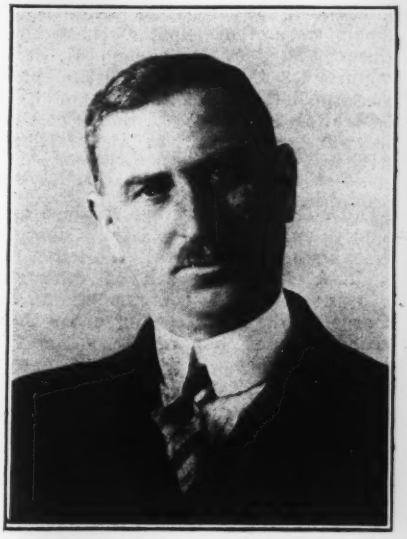
J. H. O'NEILL, general superintendent of the Great Northern Ry. lines west of Troy, Mont., has been appointed terminal manager in charge of all terminals between and including Everett and South Tacoma, Wash.

HOWARD ELLIOTT, who left the presidency of the Northern Pacific Ry. in 1913 to become president of the New York, New Haven & Hartford R.R., has returned to the Northern Pacific as president. He succeeds J. M. Hannaford, who resigned to become Federal manager.

J. M. WEIR, chief engineer of the Kansas City Southern Ry., has been made chief engineer of that line and all others under the jurisdiction of Federal Manager J. A. Edson.

E. B. TEMPLE, who has been assistant chief engineer of the Pennsylvania R.R. since 1906, has been appointed engineering assistant to C. H. Markham, regional director of the Allegheny region, United States railroad administration. Mr. Temple was graduated from Swarthmore College in 1891, and entered the service of the Pennsylvania R.R. the same year as rodman.

J. M. R. FAIRBAIRN, assistant chief engineer of the Canadian Pacific Ry., who has been appointed chief engineer, as mentioned in *Engineering News-Record* of last week, p. 104, was born in Peterborough, Ont., in 1873. He was graduated from the University of Toronto in 1893. Following brief private practice in British Columbia, Mr. Fairbairn entered the engineering department of the Canadian Pacific



J. M. R. FAIRBAIRN

Ry. as a draftsman at Winnipeg, where he served for two years. Later he was resident engineer at Place Viger, Montreal, assistant engineer at Toronto, assistant engineer maintenance of way at Montreal, and division engineer at Toronto. In February, 1911, he became assistant chief engineer.

W. A. JAMES, engineer of construction of the Canadian Pacific Ry., has been made assistant chief engineer, with office at Winnipeg, succeeding J. M. R. Fairbairn. Mr. James has been with the Canadian Pacific Ry. since 1898, successively as assistant engineer, locating engineer, division engineer and engineer of construction.

W. F. TURNER has been appointed division engineer of the Southern Pacific Co. at Ogden, Utah, succeeding Otis Weeks, who has entered other Government service.

H. S. SHOREY, formerly assistant county engineer of Grays Harbor County, Washington, has been appointed county engineer to fill the vacancy created by the death of George D. Robertson.

J. L. THAYER, deputy county engineer of Lincoln County, Washington, has resigned to become associated with F. W. Anderson Mortgage & Investment Co. of Spokane. Mr. Thayer has served two terms as county engineer of Lincoln County, and has been deputy in the office for the past three and a half years.

H. R. PRATT, recently chief engineer of the Western Maryland Ry., has been appointed engineer maintenance of way, with headquarters at Hagerstown, Md.

R. N. BEGIEN, general manager of the Baltimore & Ohio R.R., and before that chief engineer, has been appointed operating assistant to the Federal manager.

R. D. MCKEON, acting assistant division engineer of the Pennsylvania R.R., Western Lines, has been appointed division engineer at Fort Wayne, Ind., succeeding Guy Scott, who has entered military service.

FREDERIC A. DELANO, mentioned in *Engineering News-Record* of July 4, p. 60, as having tendered his resignation as a member of the Federal Reserve Board, to accept a commission in the Corps of Engineers, has received a commission as major.

HORACE H. ESSELSTYN has left his work at Hog Island as resident engineer for the Emergency Fleet Corporation of the United States Shipping Board to become commissioner of public works of the City of Detroit. Mr. Esselstyn succeeds George H. Fenkell, who resigned to become civil engineer for the Water Works Bureau, as mentioned in *Engineering News-Record* of May 16, p. 977.

I. A. COTTINGHAM, special engineer of the Texas lines of the Southern Pacific Co., has been appointed chief engineer of the Texas lines, with office at Houston.

V. K. HENDRICKS, assistant chief engineer of the St. Louis-San Francisco Ry., has been made chief engineer of all the territory of L. Kramer, Federal manager.

VIRGIL G. MARANI, consulting engineer and head of the information and promotion department of the United States Gypsum Co., has become chief engineer for the Gypsum Industries Association. Mr. Marani was graduated from the civil engineering department of Toronto University in 1893, and in the following year was engaged with Mann & White on canal work in Buffalo. Later he became sanitary engineer for Cleveland and from 1896 to 1906 was construction engineer for the Cleveland Gas, Light & Coke Co., after which he entered private practice, remaining until 1910, when he became building commissioner

for Cleveland, in which work he specialized in the matter of building codes. For the past five years he has been consulting engineer for the United States Gypsum Co., specializing in gypsum products.

F. MERRITT, chief engineer of the Gulf, Colorado & Santa Fe Ry., has been appointed chief engineer of that line and all the others under the jurisdiction of J. S. Pyeatt, Federal manager.

ALEXANDER BRESTH, formerly of the Massachusetts State Department of Health, has been commissioned as second lieutenant in the sanitary corps of the National Army.

RICHARD L. O'DONNELL, assistant general manager of the Pennsylvania R.R. since August, 1917, and previously general superintendent of the Western Pennsylvania division, has been appointed general manager, with headquarters at Philadelphia, succeeding Elisha Lee, appointed Federal manager. Mr. O'Donnell entered the service of the Pennsylvania R.R. in 1883 as a rodman, and was successively assistant engineer in the principal assistant engineer's office, assistant supervisor, supervisor of Altoona yards, assistant division engineer and division superintendent. In 1903 Mr. O'Donnell was appointed general superintendent of the Buffalo and Allegheny Valley division, and in 1911 general superintendent of the Western Pennsylvania division, from which position he was promoted to assistant general manager in August last year.

C. S. KRICK, general superintendent of the New Jersey Division of the Pennsylvania R.R., has been appointed assistant general manager, with headquarters at Philadelphia, succeeding Richard L. O'Donnell, who has become general manager, as mentioned immediately above. Mr. Krick entered the engineering department of the Pennsylvania R.R. in 1887, and worked up in the usual way, serving successively as rodman, instrument man, assistant supervisor, supervisor, assistant engineer and principal assistant engineer, from which position he was transferred in 1907 to the superintendency of the New York Terminal division, which was combined with the Hudson division to form the Manhattan division. In May, 1916, he was appointed general superintendent of the New Jersey Division.

ROBERT V. MASSEY, general superintendent of the Eastern Pennsylvania division of the Pennsylvania R.R., has been appointed general superintendent of the New Jersey division, succeeding C. S. Krick, who becomes assistant general manager, as mentioned in these columns. Mr. Massey entered the engineering department of the Pennsylvania R.R. in 1892, and after successive promotions he became division engineer of the Schuylkill division in 1907. He was later appointed division engineer of the New York division, and in 1914 was made superintendent of the Manhattan division.

N. W. SMITH, superintendent of the Middle division of the Pennsylvania R.R., has been promoted to be general superintendent of the Eastern Pennsylvania division, with headquarters at Altoona, succeeding Robert V. Massey, transferred to the New Jersey division, as mentioned in these columns. Mr. Smith entered railroad service with the Philadelphia & Erie in 1893, serving successively as assistant supervisor, supervisor and principal assistant engineer. In 1907 he became division engineer of the Middle division, and was appointed superintendent of the Central division in 1910. Subsequently he was transferred to the Middle division.

GUY G. HARVEY has resigned as county engineer of Lincoln County, Washington, to become construction engineer for the board of commissioners. He will continue to have charge of the work coming under the jurisdiction of the county engineer, and the vacancy will not be filled until after the fall election.

M. C. BYERS, recently assistant to the president of the Western Maryland Ry., has been made general manager of that road, the Cumberland Valley R.R. and the Cumberland & Pennsylvania R.R., with headquarters at Hagerstown, Md. Mr. Byers was chief engineer of the St. Louis-San Francisco Ry. from 1909 to 1913.

CAPT. A. F. PILLSBURY, district officer of the United States Shipping Board at San Francisco, has been appointed general manager of the San Francisco district, with full control of all Emergency Fleet Corporation shipbuilding operations in that district. The new appointment, made by Charles M. Schwab while in San Francisco, carries with it authority to apportion steel to the various shipyards.

W. H. WELLS, chief engineer of construction of the Southern Ry., has been made consulting engineer of construction of the Carolina, Clinchfield & Ohio Ry. and affiliated lines.

E. M. DURHAM, JR., assistant chief engineer of construction of the Southern Ry., has been appointed chief engineer of construction Mr. Durham, who was graduated from Lehigh University in 1896, has been with the Southern Ry. since 1900, with the exception of a short period, beginning in 1914, when he was special engineer in charge of valuation of the Atlanta, Birmingham & Atlantic R.R. With the Southern Ry. he was successively assistant engineer, resident engineer, principal assistant engineer and assistant chief engineer of construction.

WILLIS RANNEY, of Bartlett & Ranney, consulting engineers, San Antonio, Tex., is in Spain as superintendent of construction for the Ebro Irrigation & Power Co., Camarasa, Province of Lerida. He is installing a hydro-electric development consisting of a dam 314 ft. high, a power canal and tunnel, 30 x 47 ft., and a 100,000-hp. power house. Mr. Ranney was in charge of the design and construction of the Eagle's Nest irrigation project in New Mexico, described in *Engineering News-Record* of Dec. 6, 1917, p. 1066. Neil Hansen, his superintendent and construction engineer on the work, was left to complete the project.

R. C. WHITE, division superintendent of the Missouri Pacific R.R. at Wynne, Ark., has been appointed assistant chief engineer with headquarters at St. Louis, succeeding H. R. Carpenter, promoted as noted elsewhere. Mr. White has been with the Missouri Pacific continuously since leaving West Point in 1905, with the exception of four months last year when he was chief engineer under the constructing quartermaster in charge of the construction of the Army cantonment at Camp Pike, Arkansas. With the Missouri Pacific up to 1914, he was successively assistant in the engineer corps, assistant engineer and roadmaster, division engineer and general roadmaster. In 1914 he was made engineer maintenance of way at Little Rock, and in January, 1917, he was made division superintendent.

E. T. BOWER has been appointed assistant engineer maintenance-of-way for the Alaska Engineering Commission. He succeeds E. O. Archibald, resigned.

OBITUARY

CALVIN H. ALLEN, at one time president of the Western New York and Pennsylvania R.R., died June 14 at his home in New York City, in his 91st year. Mr. Allen entered railway service in the engineering department of the New York and Erie Railroad in 1849 and rose in the railroad world through the engineering department. At the time he was first vice-president of the New York & Philadelphia R.R. he was elected to the presidency of the Western New York and Pennsylvania road, at the same time assuming direction of a number of subsidiary companies, prominent among which was the Detroit, St. Clair River R.R. Mr. Allen retired in 1901.

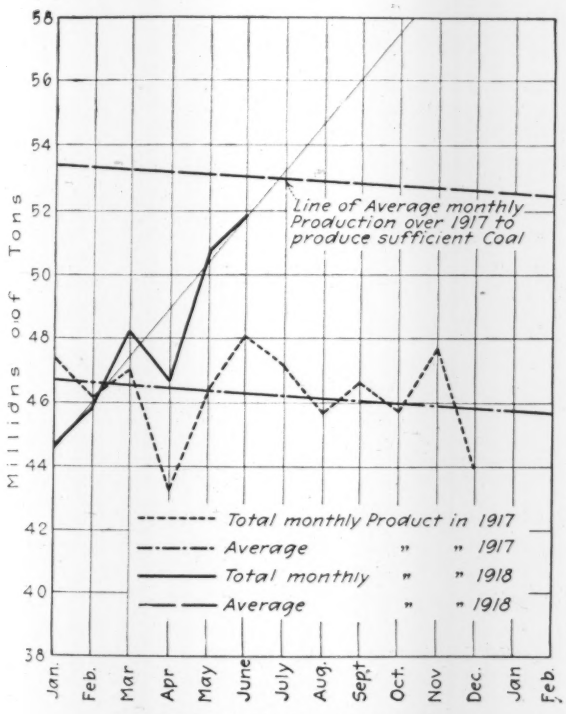
NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Rationing of Coal Includes Factories and Homes

Aim to Balance Deficiency of Production by Saving Through Campaign of Education

There will be no discrimination in favor of domestic consumers of coal at the expense of the industries in the rationing of coal by the United States fuel administration. Domestic orders will be censored to preclude hoarding, at the expense of existing supplies, and to insure economical consumption. Although the factories will be denied the use of coal in domestic sizes, domestic users will be forced to study methods to conserve their supply in order that the 20,000,000-ton saving that is the aim of the educational campaign now in progress to reach all of the 250,000 industrial power plants in the United States shall not be nullified.



SOFT COAL PRODUCTION 1917-18

The National Coal Association, composed of the bituminous operators, has taken action looking to the utmost output and asserts that it is doing everything to assure a maximum supply and to overcome the serious labor and other shortages. The results of its efforts are indicated in the marked upward slope of the average production line in the accompanying diagram. As indicated, production has mounted steadily and all previous records have been broken, but the diagram shows that extraordinary production must be continued to maintain this slope until the ordinates below the upper broken line will be balanced by those above. Latest records already indicate a flattening of this line and to offset this flattening the stringent rules of the fuel administration have been promulgated. Even as it is, the administration warns the country that a more or less serious shortage is inevitable, and urges consumers to look for and heed all future notices and regulations as well as to put into immediate practice those already issued.

Every possible saving is being put into effect. An order is in preparation, by the fuel administration, which is to take the place of the so-called "lightless night" order of Nov. 13, 1917, which was suspended on account of the daylight saving law, and the general conservation program of the Administration.

It appears that in every city and town of the country from which statistics have been gathered electricity is being greatly wasted in light for advertising, store illumination and other purposes. Radical reductions will be ordered in the quanity of coal consumed for the purposes specified. The order will provide closer restrictions in the New England states, New York, Pennsylvania, New Jersey, Delaware, District of Columbia and Maryland, than in other states where the transportation of coal is not so acute a problem.

The fuel administration has compiled a preference list in which all consumers of coal except domestic have been recorded under the following classifications: Railroads; army and navy, together with other departments of the Federal Government; State and county departments and institutions; public utilities; retail dealers; manufacturing plants on the War Industries. Board's preference list; manufacturing plants not on the War Industries Board's preference list

Building Interests Organize for War Service

Form National Federation Under Lead of United States Chamber of Commerce

Representatives of more than 100 national and regional organizations and individual firms engaged in building work and allied industries were called together at Atlantic City July 15-16 by the United States Chamber of Commerce. The National Federation of Building Industries, for the object of helping the Government, was formed.

The convention, after the opening address of Harry A. Wheeler, president of the United States Chamber of Commerce, organized by creating a war service board on which national associations will have three representatives each and a regional association one representative. This board will meet four times a year, the first meeting to be the first Monday in November, 1918. It will elect an executive committee of nine, which will transact the business of the federation, elect a president and appoint an assistant to the president. This assistant is to be a paid officer who will maintain offices at Washington, and be the point of contact between the Government and the federation, and also between the members and the executive board.

It was provided that the articles of association may be amended by a two-thirds vote of the war service committee, and the intention of later forming a permanent organization to represent the building industries after the war was expressed at the convention.

The convention was organized with Allan Walker as chairman, and a temporary executive committee, consisting of J. R. Wiggins, Philadelphia; J. H. Kane, Birmingham; A. M. Maddock, New York City; Charles Gomphertz, San Francisco; J. A. Kling, Cleveland; W. L. Clause, Pittsburgh; W. S. Dickey, Kansas City, and Rudolph P. Miller, New York City, with B. F. Affleck, president of the Portland Cement Association, as president, elected to serve until November.

Manufacturers of products used in building and construction work, and of construction equipment, were well represented, while the Engineering Council, the American Society of Electrical Engineers, a number of chapters of the American Institute of Architects, the National Association of Builders' Exchanges and several contractors' associations sent delegates.

The convention was addressed by Senator Calder, New York, and by Louis A. Post, assistant secretary of labor.

Store-Door Freight Deliveries to Be Inaugurated

Railroad Administration Expects to Increase Terminal Capacity 50 Per Cent by New Order

Store-door deliveries for freight in the Borough of Manhattan, New York City, have been ordered by the railroad administration. The district covered by this order of Director General McAdoo, is that south of 59th St., and all railroad freight delivered at piers and yards in this district will be affected. It is expected that the system will increase the amount of freight that the railroads can handle from 30 to 50 per cent. The action was taken after an extensive investigation of conditions by a committee composed of the Hon. James S. Harlan of the Interstate Commerce Commission, the Hon. Travis H. Whitney of the New York Public Service Commission, and the Hon. W. E. Donges, of the New Jersey Public Utilities Commission. A comprehensive report of their findings was submitted to the Director General of Railroads by Commissioner Harlan, a brief summary of which follows:

The congestion of railroad terminal facilities, during the past year, was partly due to the destruction of shipping by submarines and inadequate railroad facilities, but a great proportion of this congestion was caused by the conditions of delivery in New York and the antiquated methods followed. The conditions in lower New York are peculiar. There are very few team tracks where trucks can back up to the car door and receive goods for delivery.

Freight Stored on Piers

Much of the freight, whether it is in carload lots or less, must therefore be unloaded at piers and stored until claimed by the consignee. Moreover, the owner is allowed 48 hours after receiving notice to claim the freight, which time, due to slow notification, is often extended to three days. It is also found that a large portion of the trucks delivering these goods carry only partial loads, often only one box. This leads to congestion at the terminals, trucks having to stand in some cases as long as 60 hours waiting for their loads. The freight itself is unloaded in haphazard manner, so that it is difficult for the truck driver to locate his consignment of freight, and a recent count showed 100 drays, at 7 a.m. waiting at one pier for loads.

Under the new plan, notice will not be given to consignees until the goods are delivered at his store door; the fact that he has ordered the goods being considered sufficient evidence that he is ready to receive them. The freight will be unloaded and distributed in various locations at the terminals, according to the delivery zones into which the drayage district will be divided. Only trucks registered for this work will be allowed at the piers, and instead of being partially loaded, will receive full loads for the delivery zone to which they are going.

The organization for carrying out this system will consist of a drayage director, who will have general supervision and control of the trucking of freight from the pier or freight station, after it has been unloaded. He will be assisted by drayage supervisors, one at each pier, who will direct the unloading of inbound freight. All trucks must be registered by the drayage director, who will establish such rules and regulations as will facilitate the prompt removal of freight. If freight is not accepted by the consignee, the drayage director has power to store it in public warehouses at the owner's expense.

Number of Women Increasing in All English Trades

There are at present 4,538,000 women and girls in the classified trades in England that are under the jurisdiction of the British Board of Trade. Counting all the women employed in all work throughout the United Kingdom this number will be increased to 5,000,000, whereas before the war it amounted to but 2,000,000.

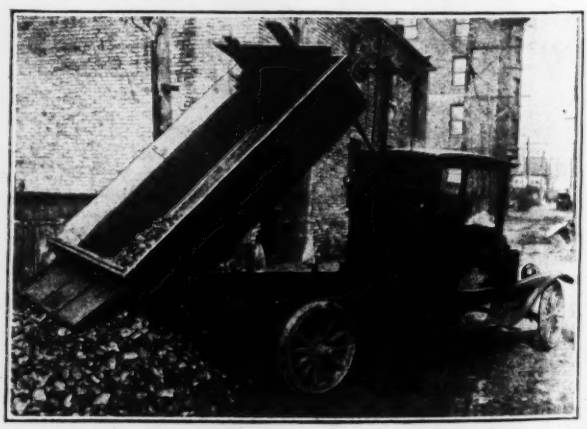
They are still being recruited to the extent of 15,000 a week, and at present are employed in all the trades that were formerly occupied exclusively by men. Munitions workers number more than 800,000, chemical and engineering establishments more than 200,000, and thousands of women work as mechanics and other hands in machine shops outside these two classifications.

End-Dump Body and Hand-Operated Hoist for Small Trucks

An end-dump body and hand-operated hoist for motor trucks is shown in the accompanying illustration. The hoist mechanism is operated entirely by hand, being a departure from hydraulic and power connected devices.

The bodies are made in various sizes, and are furnished as a unit with the hoist, ready to clamp on to the chassis of any truck. It is said that this combination is particularly adapted to the trucks of smaller size in handling all kinds of loose material such as coal, stone, gravel, etc.

When the hoist is operated by one man a load of one ton can be dumped in about 30 seconds; two tons, in 45 seconds; three tons, in 1¼ minutes; four tons, in 1¾ minutes; five tons, in 2½ minutes. This combination of body and hoist has been produced by the Archer Iron Works, Chicago.



HAND-OPERATED HOIST AND END-DUMP BODY

Business Notes

Robert F. Atkins, formerly Eastern credit manager, Universal Portland Cement Co., has been appointed credit manager of the Emergency Fleet Corporation. E. M. Johnson, formerly assistant credit manager of the Universal Co., at Chicago, succeeds Mr. Atkins at Pittsburgh, and A. J. Joyce of the Chicago office is the successor of Mr. Johnson.

The Arthur McMullen Co., general contractors, 149 Broadway, New York City, announces the opening of a Philadelphia office at 1309 Finance Building, under the direction of George B. Palmer, vice-president.

The Pittsburgh Testing Laboratory announces its recent removal from its temporary quarters, in the B. F. Jones Law Building, to its new office and laboratory buildings at 612 Grant Street, Pittsburgh. The new laboratories will be larger and better equipped than they were in the old quarters.

Trade Publications

"Monitor Sash and Operator," is the subject of Section 2, first edition, of "Fenestra Steel Windows," issued by the Detroit Steel Products Company, Detroit, Mich. It contains data, diagrams and information regarding that portion of their output.

"Pine and Patriotism" is the subject of a paper-covered book of 268 pp., embodying the official report of the third annual meeting of the subscribers to the Southern Pine Assn. Besides the financial statement it contains reports from officials in every field of operation covered by the association.